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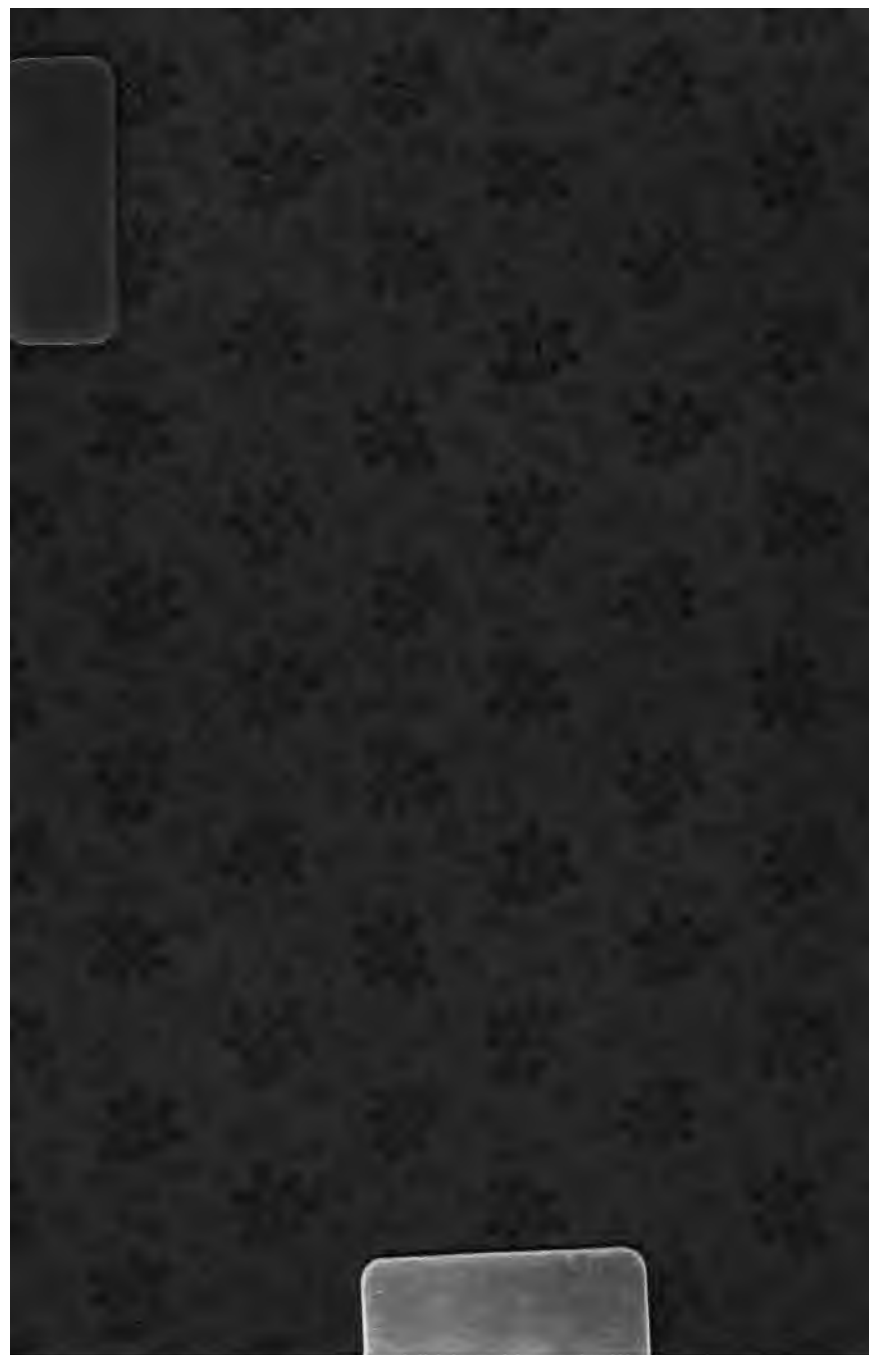


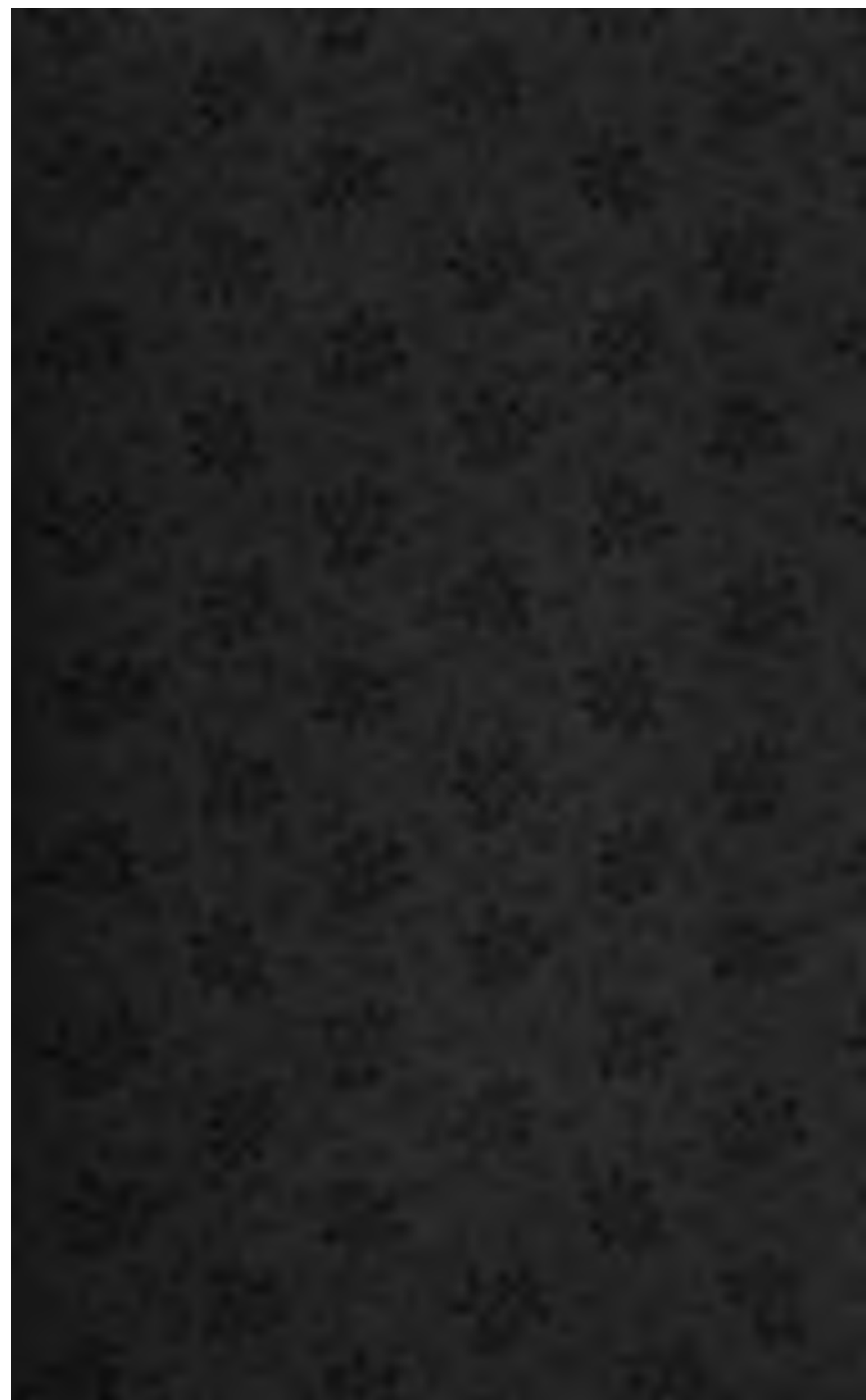
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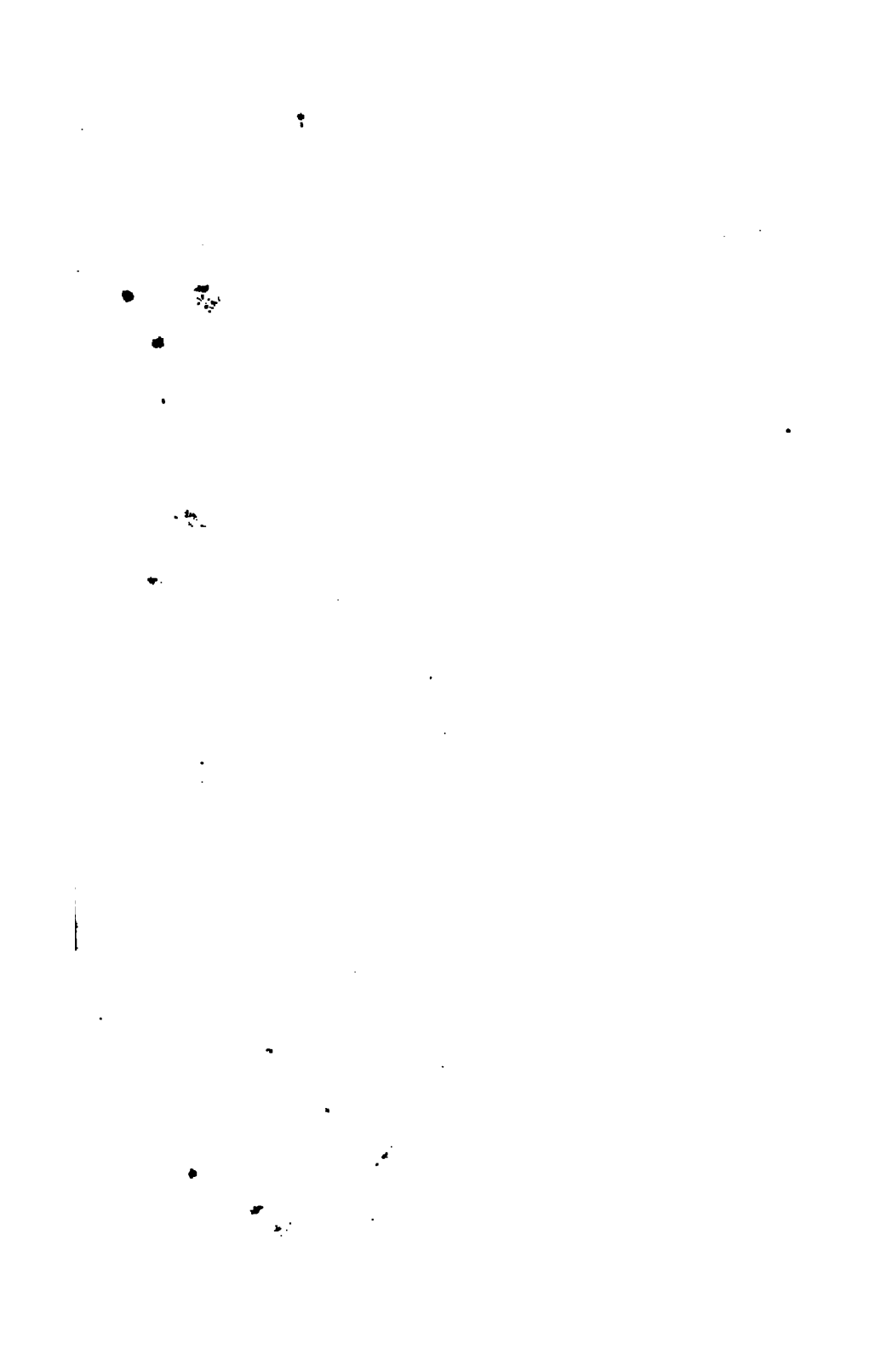


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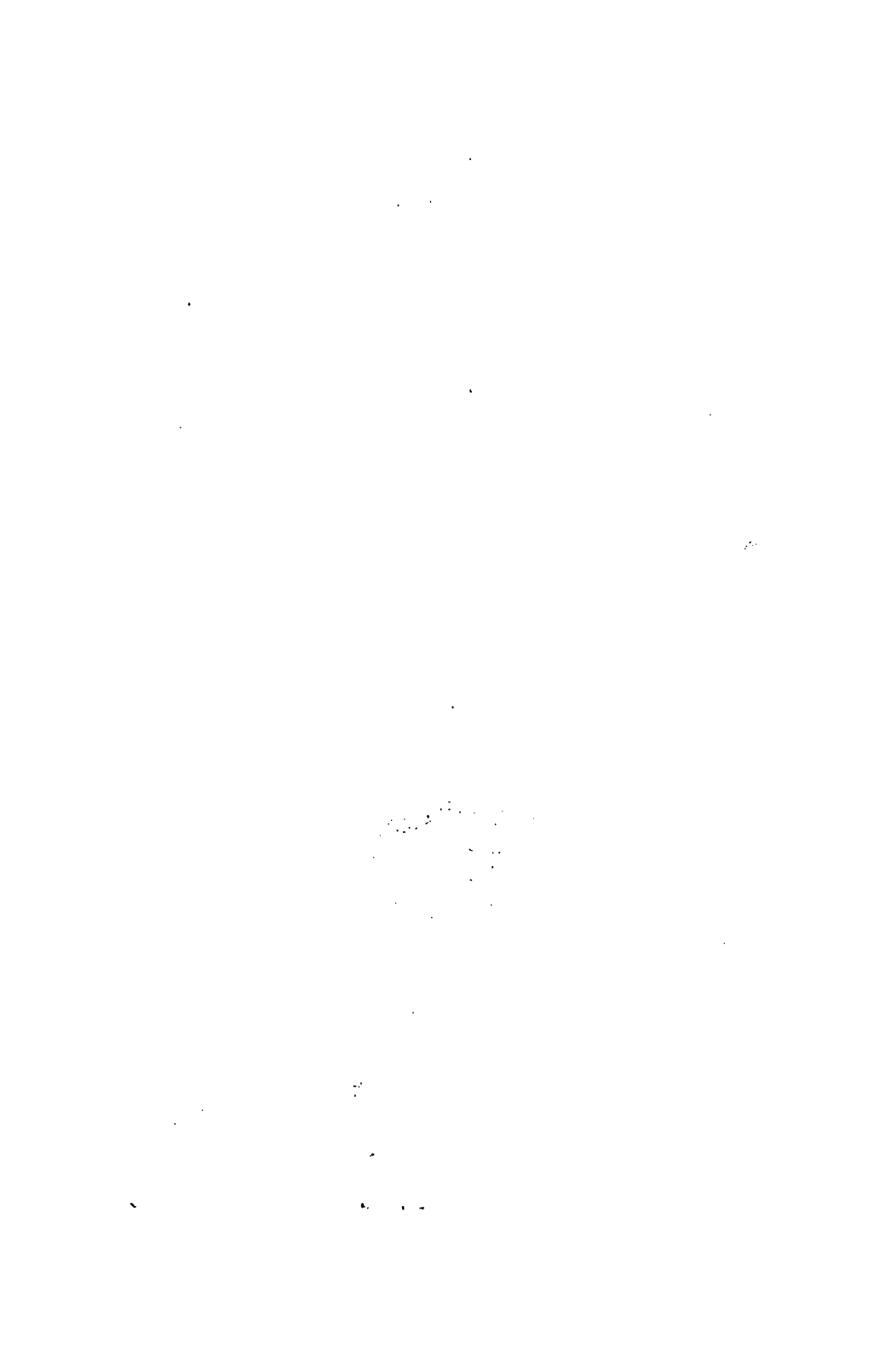








EPITOME
OF
GARDENING



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GARDENING

BY
THOMAS MOORE, F.L.S., F.R.H.S.
CURATOR OF THE BOTANIC GARDEN, CHILSKA

WITH AN INTRODUCTORY CHAPTER
ON THE PRINCIPLES OF HORTICULTURE

By MAXWELL T. MASTERS, M.D., F.R.S.



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P R E F A C E.

THE following EPITOME OF GARDENING was written as a treatise on the important industry of HORTICULTURE for the pages of the *Encyclopædia Britannica*. Such a treatise, it has been represented to us, might prove a useful manual for amateurs and others, to whom a handbook like the present often proves more acceptable than an exhaustive and ponderous volume; and therefore it has been thought desirable to issue it in a separate form.

The article "Horticulture," as it stands in the pages of the *Encyclopædia*, is founded on Dr Neill's original treatise as revised by Mr M'Intosh. Such portions of this article as were deemed suitable have been retained, and recast, sundry additions have been incorporated, and the most important omissions have been made good. In this way an attempt has been made to give, under definite heads, a brief account of the whole subject of modern practical gardening in a form likely to be useful and easy of reference. In thus modernising the tone of the article, the vast amount of information now being

constantly collected and disseminated by the horticultural press has not been overlooked.

To the *Encyclopædia* article sundry additions have here been made, the better to adapt it for independent use, and to compensate for the eliminated references to separate articles in other parts of that great work. Dr Masters has, with this object, amplified his remarks on the Principles of Gardening; and a few additions have been made in other places. Besides this, the chapters on Flowers, Fruits, and Vegetables have been lightened up by the introduction of numerous figures, for the use of which we have to thank many kind friends, notably MM. Vilmorin, Andrieux et Cie of Paris, M. Heinemann of Erfurt, and MM. Haage et Schmidt of Erfurt. We also owe our obligations to Messrs Barr & Sugden of Covent Garden, Messrs Carter & Co. of Holborn, Messrs Daniels of Norwich, Messrs Hooper & Co. of Covent Garden, Messrs Ker & Son of Liverpool, Messrs W. H. Quick & Co. of Barnstaple, Mr T. F. Rivers of Sawbridgeworth, Messrs Sutton & Sons of Reading, Messrs Veitch & Sons of Chelsea, Mr T. S. Ware of Tottenham, and Mr B. S. Williams of Holloway, whose contributions in the shape of illustrations add much interest to the pages of our EPITOME. We feel that our especial thanks are due to MM. Vilmorin for the prompt and bountiful manner in which they have assisted us herein.

We have styled our volume an EPITOME, inasmuch as the space at our disposal did not permit that so

wide and comprehensive a subject as that of modern Horticulture should be at all fully treated. Hence it may be useful, in this place, to indicate the sources whence further information on the details of garden practice may be sought with the best prospect of being found by those who may be led on to require it. Every one interested in gardening matters should read the weekly and monthly journals devoted to the subject, and besides these we may recommend the following:—As standard works on the General Subject, Thompson's *Gardener's Assistant*, which the critics have pronounced to be "the best book on general practical horticulture in the English language," and which we have adopted as our standard of practice; and M'Intosh's *Book of the Garden*, whose two thick volumes are full of useful information on all branches of gardening; or, as a less bulky tome, Loudon's *Horticulturist*, revised by Robinson. In the department of Fruit Forcing, Mr D. Thomson's *Fruit Culture under Glass*, Mr W. Thomson's *Treatise on the Grape Vine*, and Mr A. F. Barron's papers on "Vines and Vine Culture," in the *Florist and Pomologist*, are sound and practical; while in Hardy Fruit Culture many useful hints may be gleaned from Mr Rivers's *Orchard House*, M. Baltet's *Art of Grafting and Budding*, and M. Dubreuil's *Treatise on Fruit Trees*, either in the original French or as translated by Wardle. In the Flower Garden Department reliable information will be found in Mr Hemsley's *Handbook of Hardy Trees, Shrubs, &c.*, Mr Burbidge's

Propagation and Improvement of Cultivated Plants, Messrs Moore & Jackman's *Clematis as a Garden Flower*, Mr D. Thomson's *Handbook of the Flower Garden*, Mr Robinson's *Hardy Flowers and Alpine Flowers*, and Mr Douglas's *Hardy Florists' Flowers*. Mr W. Paul's *Rose Garden* and his *Roses and Rose-Culture*, with the *Rose Annual* of each year for its novel information and illustrations, may be safely consulted in reference to the queen of flowers; while of such special subjects as Orchids and Ferns, the most trustworthy of available publications are Mr Williams's *Orchid-Grower's Manual*, Mr Burbidge's *Cool Orchids*, and Mr Williams's *Select Ferns and Lycopods*. For information on Vegetable Culture, Mr Earley's *High-Class Kitchen Gardening* may be consulted; and for sound and valuable hints on Window Gardening, Mr Burbidge's *Domestic Floriculture*.
T. M.

March 1881.



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EPITOME OF GARDENING.

PART I.



HORTICULTURE or Gardening embraces both the art and the science of the cultivation of garden plants, whether for utilitarian or for decorative purposes. The subject naturally divides itself into two sections, which we here propose to treat separately, commencing with the science, and passing on to the practice of the cultivation of flowers, fruits, and vegetables as applicable to the Home Garden.

CHAPTER I.

PRINCIPLES OR SCIENCE OF HORTICULTURE.

Horticulture, apart from the mechanical details connected with the maintenance of a garden and its appurtenances, may be considered as the application of the principles of vegetable physiology to the cultivation of plants. The lessons derived from the abstract principles enunciated by the physiologist, the chemist, and the physicist require, however, to be modified to suit the special circumstances of

plants under cultivation. The necessity for this modification arises from the fact that such plants are subjected to conditions more or less unnatural to them, and that they are grown for special purposes which are at variance, in degree at any rate, with their natural requirements.

The life of the plant makes itself manifest in the processes of growth, development, and reproduction. By growth is here meant mere increase in bulk, and by development the series of gradual modifications by which a plant, originally simple in its structure and conformation, becomes eventually complicated, and endowed with distinct parts or organs. The reproduction of the higher plants takes place either asexually by the formation of buds or organs answering thereto, or sexually by the production of an embryo plant within the seed. The conditions requisite for the growth, development, and reproduction of plants are, in general terms, exposure, at the proper time, to suitable amounts of light, heat, and moisture, and a due supply of appropriate food. The various amounts of these needed in different cases have to be adjusted by the gardener, according to the nature of the plant, its "habit" or general mode of growth in its native country, and the influences to which it is there subjected, as also in accordance with the purposes for which it is to be cultivated, &c. It is but rarely that direct information on all these points can be obtained; but inference from previous experience, especially with regard to allied vegetable forms, will go far to supply such deficiencies. Moreover, it must be remembered that the conditions most favourable to plants are not always those to which they are subjected in nature, for, owing to the competition of other vegetable forms in the struggle for existence, liability to injury from insects, and other

adverse circumstances, plants may actually be excluded from the localities otherwise best suited for their development. The gardener may therefore, by modifying, improve upon the conditions under which a plant naturally exists. Thus it frequently happens that in our gardens flowers have a beauty and a fragrance, and fruits a size and savour denied to them in their native haunts. It behoves the judicious gardener, then, not to be slavish in his attempts to imitate natural conditions, and to bear in mind that such attempts must sometimes necessarily be failures. The most successful gardening is that which turns to the best account the plastic organization of the plant, and enables it to develop and multiply as perfectly as possible. Experience, coupled with observation and reflexion, as well as the more indirect teachings of tradition, are therefore of primary importance to the practical gardener.

Plant Architecture.—For details relating to the structure of plants and the arrangement of their several parts, reference must be made to the text-books of botany. In like manner works on chemistry and physics must be consulted by those who are desirous of fully understanding the bearings of physiological and physical science on practical horticulture. All that it is proposed to do in this place is to indicate certain salient matters which it is especially desirable that the gardener should bear in mind. It may be assumed that the reader is familiar with the forms and arrangements of the parts of any ordinary flowering plant, its roots, leaves, the several parts of its flower, and so forth, but it is at the outset desirable to call attention to the fact that popular language often conveys erroneous ideas. It would not be necessary in this place to allude to such a subject if such errors were not likely to

give rise to corresponding mistakes in matters of practice. Under the term root, for instance, as used in general language, various organs are included which are not true roots, such as underground stems or stocks, and tubers or underground shoots or bulbs, which may be more justly called modified buds. These organs act as reservoirs or storehouses for water and various nutritive matters, and they are provided with buds which in due time will develop into shoots. As their structure and mode of life are different from those of roots proper, and they are grown for different purposes, so the cultural proceedings requisite for their growth or improvement may be and are different from those adopted in the case of true roots. Between stem and leaf there is not, in general, any practical difficulty in discriminating, nevertheless, some leaves assume the guise of stems or of branches, and some stems or branches are more like leaves, *e.g.*, *Ruscus*, *Epiphyllum*. In this case cultural procedures would not be greatly affected, because the conditions favourable for the one would be equally so for the other. The words "flower" and "fruit" are also used loosely by gardeners, and include not only organs properly so called, but also others which have no real claim to such designations. So long as this erroneous use of terms does not affect practical cultivation, the matter is one rather for professed botanists than for gardeners, but it will be easy to see from one or two illustrations that the principles applicable to the growth of flowers proper require to be modified when it is some other organ which it is in reality specially desired to develop. In the case of the *Poinsettia*, or of the so-called arum-lily (*Richardia aethiopica*), the part that is so conspicuous, and for which the plant is cultivated, is not the flower but the

bract or spathe, white in the one case, crimson in the other. The true flowers are in these cases relatively inconspicuous. Under natural conditions the main object of the flower is the production of seed, but in the case of the two plants just mentioned the gardener cares much less for the formation of seed than he does for the production of the coloured bracts. Now, the conditions under which the two, seed and bract, are formed are to a considerable extent different, and the gardener who, relying on the identity of name, should adopt for the one methods of culture suitable for the other would be led astray. In the case of the fig, the apple, the pear, the strawberry, the portion ordinarily called fruit has, in reality, but little claim to that appellation. The so-called fruit of the three first mentioned consists of a swollen flower-stalk in which the true fruits are imbedded. In the strawberry the true fruits are the small "pips" which may be seen projecting from the surface of the greatly swollen "receptacle" or thalamus. Again, in the pineapple, the real fruits and seeds form but a very insignificant portion of the succulent mass which goes by the name of fruit. The necessity of bearing these distinctions in mind may be illustrated by the fact that, in inverse proportion to the degree of development attained by the so-called fruit in such instances as we are alluding to, is the quantity or quality of the seed—not, indeed, in all cases, but very frequently so, and amply sufficient to illustrate our point that the gardener is directly interested in morphological distinctions which, at first sight, might seem to concern botanists only.

Kinship of Plants.—The natural relationships of plants which it is the object of systematic botany to discover and of classification to arrange, must also receive some

attention from the gardener, not only from the intrinsic interest of the subject, but also from the information he will thereby gain as to the probable requirements and habits of the plants under his charge. If, for instance, he wish to favour the growth of clover (*Leguminosæ*) on his lawn, he will find it advantageous to use other means than if he wished to encourage the grasses (*Gramineæ*), and *vice versa*, the requirements of the members of one natural order being often different from those of another.

Plant Construction.—So far as regards the internal or microscopical structure of plants, reference must also be made to text-books, but for the understanding of what is to follow, it may be well to state that the plant is wholly cellular in construction. The constituent cells are of very varied forms, and they are arranged in various ways, but in every case they consist of an outer case of elastic membrane called the cell-wall, more or less permeable to water, and thickened or not by deposit on the inner side. The cell-walls enclose, at least in the active growing condition, a quantity of viscid matter known as protoplasm, in which are one or more nuclei and a quantity of water known as cell sap. The protoplasm is the essential part of the cell, inasmuch as it is the agent by means of which all the processes of life are carried on. Without it the plant could neither feed, breathe, move, grow, nor reproduce itself—with it all these processes are effected. When the protoplasm dies the cell dies. The plant, then, may be considered as made up of a number of bags or cells of protoplasm of different forms and varied arrangement. These cells have, or may have, each an individual existence apart from its neighbours; but it is more common for the cells to be more or less dependent one on another. Still,

although the cells thus live as a community, it is well to remember that each cell is complete in itself, and that any individual cell may and often does carry on its operations in a different manner to its neighbours. It is in virtue of this circumstance that we find different cells in juxtaposition containing, some starch, others colouring matter, and so forth, although to all appearance there is nothing in the structure of the cells to account for this difference of their contents. The individuality of cells is a matter of much interest to gardeners in connexion with the various modes of propagation by cuttings, grafts, &c., which would not be practicable were it not for this capacity on the part of cells of living apart from their fellows.

The woody fibres which go to make up the bulk of a timber tree are nothing but cells of a particular form thickened by the deposit of woody matter in their interior, and aggregated in a particular way.

From what has been said, it will be seen that, to understand the actions that go on in plants, it is requisite, before all, to be acquainted with the properties and mode of action of the cell-membrane and of the protoplasm. Without entering into details, it may here be said that the chief uses of cell-membrane are to shield the protoplasm from injury, to act as a filter and allow of the passage of fluids and gases into and out of the cells.

To the protoplasm belong the more important phenomena connected with the nourishment of the plant, the power of contraction and expansion, the sensitiveness, the mobility, and the many chemical and physical changes connected therewith; by its subdivisions the growth of the plant is effected; by the setting apart of distinct portions of its substance for distinct purposes sexual reproduction is

effected, and in it various secretions are formed. The power of locomotion is also possessed by some of the lower plants by virtue of distinct masses of protoplasm, which move from place to place. In these cases the protoplasm is uncovered by cell-wall, but when it comes to rest cell-membrane is developed from its surface.

The cell-membrane when analysed by the chemist is seen to have a constitution closely like that of starch or sugar, the protoplasm differs essentially in the admixture of a certain quantity of nitrogen in some form of combination. In the case of the cell-wall we have ternary combinations of carbon, hydrogen, and oxygen; in that of the protoplasm we have the same elementary substances in combination with nitrogen and often minute proportions of sulphur and phosphorus. In addition to these organic or carbon-compounds, various mineral ingredients are found in the cells or in the cell-walls, such as salts of potash, lime, magnesia, iron, and many other earthy ingredients in variable proportions in different plants, and even in different parts of the same plant. In addition to these materials, there is always a large bulk of water in all parts of the plant, so large, indeed, that much the larger portion, by weight, of any plant consists of water.

Plant-Nutrition.—These substances must come from without, they cannot be generated within the plant. They must be taken up from the air, the water, or the soil in which the plant lives, and hence the necessity for chemically studying the food of plants and the sources whence it is derived. Moreover, although the chemist tells us that such and such ingredients exist in the plant, and that they are derived some from one source, some from another, yet it must be borne in mind that in the plant they do not

exist as a rule in the isolated state in which they figure in the analysis of the chemist, but in very varied combinations, and that during the growth of the plant they are subject to frequent changes and to transport from place to place according to the requirements of the plant. A plant, then, may be regarded not only as a machine, doing certain work, but as a laboratory in which very complicated changes are taking place, consequent on the absorption of some matters, their decomposition, combinations, storage, or elimination. These changes, in a broad sense, may be comprised under the heads of absorption, transport, elimination, and change.

Root-Action.—Absorption is confined to liquids or gases, for solid matters cannot be absorbed. It may take place in all active parts of the plants where not prevented by structural peculiarities, but, for practical purposes, it is necessary only to refer to what takes place in the roots and in the leaves. The greater part of the water found in plants, and the earthy or mineral ingredients, including the nitrates, which furnish the nitrogen to the protoplasm, enter the plant by means of the roots. Probably gaseous matters may also be absorbed by the roots. Absorption of fluids by the roots is due to diffusion or osmosis, by virtue of which liquids of different densities have a tendency to mix, the thinner passing into the thicker liquid through the cell-walls.

But we do not find in the soil exactly the same solutions as we find in the root. Again, some of the ingredients in the soil are practically insoluble in water, and yet they are found in the plant. How then, do they gain access? The answer to this question probably lies in the fact that the roots not only absorb water, but that they have the power

of dissolving particles of mineral substances with which they come in contact by the agency of an acid secretion from the cell-wall, or possibly by the temporary exudation of some solvent fluid, which, having served its purpose, is immediately reabsorbed. It must also be borne in mind that in a well-drained, well-aerated soil, where there is no stagnant moisture, and where air has free access, that there is a continual change going on, the water by means of capillary action and evaporation from the surface, under the influence of varying temperature, is constantly in motion, and chemical changes and combinations are taking place which render an insoluble substance soluble and fit for absorption by the plant. The absorption of feeding substances by the roots is, of course, a matter of primary importance in questions of artificial manuring. The principle of manuring is to supply at the right time, and in the right quantities, such ingredients as are known to favour the growth of the particular plant, or to stimulate the development of certain of its portions, and which are deficient in the soil. Mere analysis of a plant does not always indicate the kind of manure to be used; thus it has been repeatedly shown by Lawes and Gilbert that leguminous plants which contain so much nitrogen in their composition are not characteristically benefitted by nitrogenous manures, and, on the other hand, that cereal crops are not specially benefitted by the application of mineral manures as from their composition it might be expected would be the case. The effect of a diminished supply of a particular ingredient, say potash, may be well illustrated by the results of experiments at Rothamsted, where two plots of grass land side by side were at first manured exactly in the same manner with mixed mineral

and nitrogenous manures, but, after some years the potash was omitted from the one plot while the manurial condition of the other was unchanged. The effect of the disuse of the potash has been to cause a great decrease of produce, to induce a very much darker green colour in the herbage than where the potash is used, and a greatly diminished assimilation of carbon by means of the chlorophyll of the leaf as hereafter explained. In other words, to quote Dr Gilbert's expression, "the nitrogen was there, the chlorophyll was there, there was the same sunlight for both plots, but the assimilation work was not done where there was not a due supply of potash." Again, mineral constituents may be liberally provided, but in the absence of a sufficient supply of nitrogen, there is defective assimilation of carbon.

Analysis of the soil may reveal absolute deficiencies of potash, phosphates, or nitrogenous matters, as the case may be; or it may give evidence of their presence in a form not suitable for plant food. But, on the whole, the safest plan for the cultivator to adopt is to try experiments, on a small scale, by growing plants under different conditions of manuring, and thus to ascertain what are the manures most likely to be of service to him in growing particular plants on a larger scale. In any case it is, in general, not difficult to ascertain what substances are beneficial and what injurious, and, approximately, in what proportions, regard being constantly had to the stage of growth of the plant and to the influence of climatal conditions. Thus, in the case of water, experiments have been made to determine what amount is most beneficial in the following manner:—A number of plants of the same kind in pots or in plots were watered during the period of growth with various quantities of water, other conditions being equal.

In this manner Hellriegel found that of six plots of buckwheat observed during six days and supplied during that period with a total quantity of water, varying in the different plots from about 2 to about 25 gallons respectively, that which received the medium amount (12 gallons about) was most productive, heavier both in stem and seed, and bore the largest proportion of seed. Of the two extremes, deficient supplies of water were far more prejudicial than excessive quantities. Similar experiments of Nobbe have shown that, as a general rule, the best effects are produced when the proportion of mineral ingredients (including nitrates) to water is as 1 to 1000, and the growth of plants was checked when the proportion was reduced below 0.5 or increased beyond 2 parts in the thousand. Similarly, it has been shown with regard to potash that the largest produce of barley is obtained when used in the proportion of 71 to 1,000,000 lb of soil. It has, moreover, been abundantly proved that if nitrogen in some form or other be deficient in the soil, no considerable plant-growth takes place even though the mineral ingredients exist in sufficient amounts. The exact amount of nitrogen to be applied with most benefit of course varies with different plants and under different conditions, but as an illustration of the range of difference, reference may be made to an experiment of Hellriegel showing the increased amount of nitrogen observed in the grain of various cereals grown in soils known to contain nitrogen in amounts varying from nothing to 84 parts per 1,000,000 of soil; to mention only one case, the increased yield of grain varied from about half a pound to more than 9 lb. Here it was not the largest quantity of added nitrogen which produced the best result, for, while with 42 parts per million the yield was aug-

mented by 6 lb, double the quantity only yielded 9·2 increase, and the same fact is brought out in the experiments of Lawes and Gilbert. Again, in the application of manures it is requisite to take into consideration the purpose for which the plant is grown, for, while some manures, such as ammonia-salts, specially favour the production of leaves, others, on the contrary, are more propitious to the formation of woody fibre. The quality, too, of the product is much influenced by the manure. The enormous roots seen at agricultural exhibitions are by no means those which contain relatively the largest amount of nutritive matter. Growth has been stimulated to an inordinate degree, but the formation of those principles which give special value to the crop is checked rather than otherwise. These facts should be specially borne in mind by the kitchen gardener and the fruit cultivator.

Leaf Action.—While the absorption that takes place by means of the root is principally, though not exclusively, that of fluids, so the absorption that takes place through the agency of the leaf is chiefly, but not exclusively, that of gaseous matters. Atmospheric air containing nitrogen, oxygen, carbonic acid gas, watery vapour, and sometimes ammonia, is absorbed readily by the leaves and green surfaces. Under the influence of light, and particularly of the yellow and red rays, the carbonic acid gas is split up into its constituents,—the carbon remains fixed in the plant, the oxygen gas is given off. The plant in this manner gets its supplies of carbon exclusively or almost exclusively from the atmosphere. The oxygen which it gives off under the influence of sunlight is not all derived from the decomposition of the carbonic acid gas taken up, much of it is due to the constant deoxidation

which goes on in compounds absorbed by the roots, in the course of their transformation into vegetable substance and vegetable secretions. Nitrogen, though existing in such large proportions in the air, is not absorbed in a free state by the leaves, as has been proved by Lawes and Gilbert : plants obtaining their nitrogen by means of their roots in the form of soluble nitrates, or of ammonia salts. Ammonia vapour is also probably taken up by the foliage. The intermixture of gases in plants, like that of fluids, takes place by diffusion, and, as carbonic acid gas and ammonia gas are absorbed by the plant from the atmosphere, fresh supplies are constantly passing in by diffusion, so that, although the actual amount of carbonic acid gas or ammonia in the air be very small, yet there is a constant stream flowing into the plant, which thus receives in the aggregate a large supply.

But, while in the presence of green colouring matter (chlorophyll), and, under the influence of light, carbonic acid gas is split up in the manner just indicated, the converse process is going on, but in a feebler degree, in all living parts of the plant in light or in obscurity. This absorption of oxygen gas and giving off of carbonic acid gas in plants is quite analogous to what takes place in animals, and, like it, may be considered as the essence of the process of respiration. That two antagonistic processes should go on at the same time is explained by the fact that the assimilation of carbon and the consequent formation of starch is very active while the elimination of carbonic acid is relatively much less energetic. Moreover, the two processes may be and probably are carried on in different cells. Reference has already been made to the frequent independent action of contiguous or neighbouring cells. In an ordinary leaf

the most common arrangement of the cells is such that those on the upper surface are densely packed and filled with chlorophyll, while those on the lower surface are less closely aggregated, and relatively deficient in chlorophyll. The upper set of cells then are specially occupied in processes of nutrition dependent on the action of light, the lower ones in processes of respiration and transpiration, for which not only the spongy structure but the larger number of breathing pores (stomata) on the lower epidermis or skin are specially adapted. The actual functions of the chlorophyll, whether, as till lately supposed, connected with the breaking up of carbonic acid gas and the retention of the carbon, or whether, as indicated by the recent researches of Pringsheim, they are concerned in the regulation of the respiratory action, are further mentioned under the head of leaves. It must suffice to repeat here that, just as by the process of diffusion, fluids are absorbed by the root and pass in various directions through the plant, so there is also a constant interchange of gases in the plant by means of the corresponding process of gaseous diffusion, and a constant influx from the outer air, thus giving rise to continuous currents in one direction or another.

The absorption of water by the leaves and green parts has sometimes been denied, and, indeed, the structural arrangements are sometimes such as to render the leaf impervious; nevertheless, in other cases there can be no doubt from the experiments of Boussingault and Henslow that absorption of water really does take place from the surface of leaves, more particularly when the supply of moisture to the root is deficient.

While there are constantly going on in the living plant processes of absorption of fluids or gases by the roots and the

green portion, so there is going on an outpouring of gases and of fluids at least from the leaves. This much has been implied from what has been already said, but the evaporation of water from the surface demands further notice. The amount of water evaporated from the surface of the leaves naturally depends on the amount absorbed by the root, on temperature, on the varying structure of the leaf in different plants, and so forth. Hales' celebrated experiments (1727) showed, for instance, that the evaporation from the cabbage was much greater for the same amount of surface than in the case of the lemon or the vine. Similar experiments made by Miller in the Botanic Garden, Chelsea, showed that a greater quantity was evaporated in the morning than in the afternoon, and that the amount was in proportion to the temperature of the day. It has subsequently been shown that exposure to light has an equal if not greater influence. The experiments of Lawes, as detailed in the *Journal of the Horticultural Society of London*, vol. v. (1850) p. 38, and vol. vi. (1851) p. 226, are most important from a cultural point of view. They show that there is great difference between the evaporating power of different plants placed under the same circumstances, but that, as a rule, evergreens evaporate less in proportion than do plants with deciduous leaves under the same conditions. The same observer has shown that the weaker the solutions absorbed, the purer and consequently the less nutritious the water absorbed by the root, the greater the amount of evaporation from the leaf. Where the water contained mineral matters and ammonia, for instance, the evaporation was much less. Later researches of Sachs, Dehérain, and others have shown that, contrary to what might have been expected, the evaporation of water

goes on as well in a saturated as in a drier atmosphere. Young leaves evaporate more than old ones, by reason, no doubt, of the greater activity of growing tissues. Further, it has been shown by Daubeney, Dehérain, Sachs, and others, that the evaporation of water is especially determined by the action of light, especially of the yellow rays.

Influence of Climatal Conditions.—In considering the absorption and exhalation of water and of gases, reference has been made to conditions of temperature, light, and moisture. It is certain that plants will not grow, or will even die, if exposed to excess or deficiency of either of these agents. Moreover, it is obvious that between these extremes there is a mean which is the best suited for the plants' requirements. So far then, as regards the amounts of heat, light, and moisture, there is a "maximum," a "minimum," and an "optimum." But these proportions differ extremely in different cases, and even in the same plant, at different stages of growth, and even at different times of the day. It is a well recognized rule, for instance, in cultivation that the night temperature should be lower than that by day. Moreover, these agencies do not act separately on the cultivated plant but in combination in various degrees. It is the business of the experimenter in the laboratory to isolate these conditions so far as he can, to ascertain what is the nature and amount of the influence exerted by temperature by itself, or of the light by itself, and so on. But, although this is essential for the physicist, the gardener is more directly concerned with the combined effect of these agents on the growing plant. He would not wish to subject his plants, if he could, to one set of conditions only, but to that combination which is most favourable for plant growth or for the purposes for which he grows plants. It

follows, therefore, that the information obtained from experiments made in the laboratory is, for the practical purposes of the gardener, less immediately important than that derived from the study of climatal conditions and the vegetation of different countries at different seasons. This fact has been recognized from the time when it was ascertained that the vegetation of the tropics was different from that of the temperate zones, and it has been acted on in practice by providing greenhouses or stoves and other artificial means of producing a climate variable according to the requirements of particular plants. Assuming then a knowledge of the climatal and other conditions under which plants naturally grow, the experiments made by the gardener in his attempts to grow them are, for practical purposes, more important for him than the abstract researches of the chemist or the physicist. It is, however, desirable that the gardener should conduct his experiments, so far as circumstances will allow, with the same accuracy, method, and careful record as the philosopher, and to do this some acquaintance with general principles is essential.

Action of Light.—Light varies in its effects according to its colour: the yellow rays favour absorption and exhalation, they are essential to the formation of chlorophyll and to the deoxidizing process that goes on by its agency. The blue rays influence the rapidity of growth, the degree of movement, and the amount of tension in the cells. Many of the secretions—the starch, the sugar, the colouring matters—cannot be formed in the absence of light. It must, however, be remembered that if the plant has at some previous time been able to store up in its tissues reserve matters,—formed in consequence of exposure to light—it may afterwards, even when grown in obscurity,

form the secretions from the reserve matters already alluded to. The success of forcing operations depends very materially on this fact. In the dull season the light would of itself be insufficient for the production of the starch and other ingredients, but, owing to the reserve starch accumulated the previous season, when heat and moisture are supplied by the gardener, growth begins and the transformation of starch into sugar and so on takes place. The bending of plants to the light (heliotropism) is a familiar illustration of the effects of light. These movements are supposed to be due to the turgescence of certain cells owing to their becoming filled with dense glucose, derived from the solution of starch, and to the rush of water by osmotic action to equalize the density of the fluids in the cell. Growth by cell-division takes place as well as or better in the dark than in the light, so that it is independent of light, provided the materials for growth are stored up in the tissues by previous exposure to light, and the same remark applies to the formation of the flowers and fruit. With reference to the electric light, it is only requisite to say that so long ago as 1861 it had been shown by Hervé Mangon that exposure to the electric light produced the same effects as solar light, and the more recent experiments of Siemens prove the same fact.

Action of Heat.—So far as heat is concerned, the same remarks may be made with the requisite modifications. As in the case of light, each plant, each part of a plant, is best developed, and each function performed by it is carried on best at a certain temperature, and is checked by excess or defect. Plants suffer from radiation which lowers their temperature, but do not themselves become frozen till the temperature descends several degrees below freezing point,

the exact degree being different in different plants, and in the same plant under different conditions. If the tissues contain much water, more injury is done by frost than if the plant be relatively dry. The effect of frost is to cause exudation of the water from the interior of the cells, and the formation of ice outside and between the cells. If the thaw be effected gradually the water is reabsorbed and the life of the plant is unaffected.

The Sap.—The general result of all these processes of absorption, transmission, and evaporation, of this exposure to the combined influence of varying degrees of temperature, light, and moisture, is a constant movement of the juices of the plant, and a probable similar movement or, at least, alteration in the conditions of the molecules or ultimate particles of which the plant consists.

What is called the ascent of the sap is an upward movement of the watery fluid absorbed by the roots up between the cells, or at any rate from cell-wall to cell-wall of the young wood till the leaves are reached, where some of it is, as has been already stated, transpired. Its upward course is favoured first by osmosis, or diffusion as before mentioned, and then by capillary attraction aided by the continual pressure from the root, and, when the leaves are unfolded, by transpiration from their surface.

The ascending sap consists in the first instance, therefore, of little else but water, with a very minute proportion of saline matters derived from the soil, but in its upward course it comes into contact with the substances stored up in the tissues, and its composition becomes altered accordingly. In its upward current it facilitates the formation of the various contents of the cells, and plays an essential part in the chemical transformations which take place in them.

Further, by its aid the nutritive contents of the cell now rendered soluble and capable of transport are carried from place to place as may be required, from the cells in which they are deposited or manufactured to those standing in need of nutritive matter for their growth, or to those destined to serve as storehouses for future requirements, or again, from storehouses to the points where growth is going on. It will be seen, then, that the term "circulation of the sap" is misleading, there is no such continuous regular up and down current as this term would imply, but, an ascent of water from the root and a movement of the nutritive fluids not only downwards but in any direction where they may be wanted, or where they are forced to go by physical causes. In like measure the term sap is misleading in so far as it implies either an ascending or a descending fluid of uniform composition and quality. The so-called sap varies in composition in different parts of the plant, and the direction in which it is moved is also different. Moreover, there is no continuous series of channels in the plant through which such an ascending and descending current as is implied by the word sap could pass.

The chemical transformations and mutations which occur in connexion with the processes and under the conditions above alluded to can only be mentioned here. They are the outcome of the active life of the plant, and necessary for its health and growth. They are, therefore, really the main objects for which the gardener grows his plants,—the principles involved in their formation have been indicated in bare outline, the precise details must be sought in chemical text-books.

Reproduction of Plants.—The process of sexual repro-

duction in plants consist essentially in the union of one portion of protoplasm representing the male element, with another which corresponds to the female element. In flowering plants, those with which the gardener has chiefly to deal, (exception being made of ferns and Lycopods), the male protoplasm is contained within the grains of pollen which are formed within the anthers. The female protoplasmic germ is formed within the ovule, the ovule itself being formed within the cavity of the ovary (or, as in gymnosperms, upon a flat scale representing the ovary). The anthers containing the pollen, and the ovule containing the germinal vesicle or "oosphere" are the really essential parts of the flower. They may be borne in the same, or in different flowers on the same, or on different plants. The immediate investment of the sexual organs, the non-essential part of the flower, consists very generally of a corolla, generally coloured to attract insects or secreting honeyed juices, which have the same effect. Outside this is the calyx, consisting usually of green segments having the same work to do as the leaves. Outside the calyx again are one or more bracts intermediate in position and often in appearance between the calyx and the true leaves, and often brightly coloured. The coloured parts of the flower—those portions which are not green and leaf-like—are chiefly characterized by their property of retaining oxygen and giving off carbonic acid gas. Details as to the variations in the number, form, and arrangement of the floral organs must be sought in the ordinary text-books.

The formation of flowers is usually preceded by an arrest of growth, and the chemical nature of the changes which take place is different from that which obtains in the leafy or green parts of the plant. The same holds good of the

fruit, which when in the green state has the same functions as the leaves, but which as it approaches maturity changes colour, takes on chemical action akin to that which occurs in the flowers, and stores food for the developing seed within it, as well as provides sustenance for birds and other creatures by whose means the seed can be dispersed.

In the ripe seed the embryo plant or seedling is contained. This is formed from the oosphere after contact with the pollen-tube by repeated cellular sub-division. It receives its nourishment either from food stored up in its own tissues, or from the albumen or perisperm surrounding it. Usually it remains for a time inert, it passes through a resting stage, and then if conditions be favourable, it germinates, germination being attended with chemical changes resulting in the solution of starchy matters and the consequent formation of nutritive fluids, in the assimilation of which carbonic acid gas is given off and a certain amount of heat evolved. It is obvious from this brief statement that the life actions of the plant when producing flowers, fruit, and seed are different from those which occur when the plant is merely growing, and the cultural proceedings should be correspondingly modified.

With this outline as to the structure and physiology of the plant in general, an outline to be filled up by reference to authentic text-books, we pass on to notice briefly the several parts of a flowering plant, and to point out the rationale of the cultural procedures connected with them.

The Root.—The root, though not precluded from access of air, is not directly dependant for its growth on the agency of light. The efficiency of drainage, digging, hoeing, and like operations is accounted for by the manner in which they promote aeration of the soil, raise its temperature, and

remove its stagnant or superfluous moisture. Owing to their growth in length at, or rather in the immediate vicinity of, their tips, to their sensitiveness to contact, to the presence of moisture, and to their power of movement, roots are enabled to traverse long distances by surmounting some obstacles, penetrating others, and insinuating themselves into narrow crevices; bending, as Darwin points out, from the harder particles of soil and following the line of least resistance. As they have no power of absorbing solid materials, their food must be of a liquid or gaseous character. It is taken up from the interstices between the particles of soil by the finest subdivisions of the fibrils, and in many cases by the extremely delicate thread-like cells which project from them, and which are known as root-hairs. The number and density of these latter are in direct proportion to the abundance and suitability of the food of the plant. The importance of the root-fibres, or "feeding roots," justifies the care which is taken by every good gardener to secure their fullest development, and to prevent as far as possible any injury to them in digging, potting, and transplanting, such operations being therefore least prejudicial at seasons when the plant is in a state of comparative rest.

Root-Pruning and Lifting.—In apparent disregard of the general rule just enunciated is the practice of root-pruning fruit trees, when, from the formation of wood being more active than that of fruit, they bear badly. The contrariety is more apparent than real, as the operation consists in the removal of the coarser roots, a process which results in the development of a leash of fine feeding-roots. Moreover, there is a generally recognized quasi-antagonism between the vegetative and reproductive processes, so that, other things

being equal, anything that checks the one helps forward the other.

Watering.—So far as practical gardening is concerned, feeding by the roots after they have been placed in suitable soil is confined principally to the administration of water and, under certain circumstances, of liquid manure; and no operations demand more judicious management. The amount of water required, and the times when it should be applied, vary greatly according to the kind of plant and the object for which it is grown, the season, the supply of heat and light, and numerous other conditions, the influence of which is to be learnt by experience only. The same may be said with respect to the application of manures. The watering of pot-plants requires especial care. Water should as a rule be used at a temperature not lower than that of the surrounding atmosphere, and preferably after exposure for some time to the air.

Bottom-Heat.—The “optimum” temperature, or that best suited to promote the general activity of roots, and, indeed, of all vegetable organs, necessarily varies very much with the nature of the plant, and the circumstances in which it is placed, and is ascertained by practical experience. Darwin has recently shown that the sensitiveness to contact and to the presence of moisture as well as the power of movement are not fully displayed if the roots be subjected either to too high or too low a temperature. Artificial heat applied to the roots, called by gardeners “bottom-heat,” is supplied by fermenting materials, dung, tan, flues, or hot-water pipes. In some cases solar heat is as it were entrapped by placing beneath the roots substances such as bricks, the heat previously absorbed by which is

slowly radiated. In winter the temperature of the soil, out of doors, beyond a certain depth is usually higher than that of the atmosphere, so that the roots are in a warmer and more uniform medium than are the upper parts of the plant. Often the escape of heat from the soil is prevented by "mulching," i.e., by depositing on it a thick layer of litter, straw, dead leaves, and the like.

Planting.—By removal from one place to another the growth of every plant receives a check. How this check can be obviated or reduced, with regard to the season, the state of atmosphere, and the condition and circumstances of the plant generally, is a matter to be considered by the practical gardener.

As to season, it is now admitted with respect to deciduous trees and shrubs that the earlier in autumn planting is performed the better; although some extend it from the period when the leaves fall to the first part of spring, before the sap begins to move. If feasible, the operation should be completed by the end of November, whilst the soil is still warm with the heat absorbed during summer. Attention to this rule is specially important in the case of rare and delicate plants. Early autumn planting enables wounded parts of roots to be healed over, and to form fibrils, which will be ready in spring, when it is most required, to collect food for the plant. Planting late in spring should, as far as possible, be avoided, for the buds then begin to awaken into active life, and the draught upon the roots becomes great. It has been supposed that because the surface of the young leaves is small transpiration is correspondingly feeble; but it must be remembered, not only that their newly-formed tissue is unable without an abundant supply of sap from the roots

to resist the excessive drying action of the atmosphere, but that, in spring, the lowness of the temperature at that season in Great Britain prevents the free circulation of the sap. The comparative dryness of the atmosphere in spring also causes a greater amount of transpiration than in autumn and winter. Another fact in favour of autumnal planting is the production of roots in winter.

The best way of performing transplantation depends greatly on the size of the trees, the soil in which they grow, and the mechanical appliances made use of in lifting and transporting them. The smaller the tree the more successfully can it be removed. The more argillaceous and the less siliceous the soil the more readily can balls of earth be retained about the roots. All planters lay great stress on the preservation of the fibrils; all indeed admit them to be indispensable for the absorption of nutriment. The point principally disputed is to what extent they can with safety be allowed to be cut off in transplantation. Trees and shrubs in thick plantations, or in sheltered warm places, are ill fitted for planting in bleak and cold situations. During their removal it is important that the roots be covered, if only to prevent desiccation by the air. Damp days are therefore the best for the operation; the driest months are the most unfavourable. Though success in transplanting depends much on the humidity of the atmosphere, the most important requisite is warmth in the soil; humidity can be supplied artificially, but heat cannot.

The *Stem* and its subdivisions or branches lengthen, not only near the tip, but also lower down, by intercalary growth. They upraise to the light and air the leaves and flowers, and serve as channels for the passage to them of fluids from the roots, and they act as reservoirs

for nutritive substances. Their functions in annual plants cease after the ripening of the seed, whilst in plants of longer duration layer after layer of strong woody tissue is formed, which enables them to bear the strains which the weight of foliage and the exposure to wind, &c., entail. The gardener aims usually at producing stout, robust, short-jointed stems, instead of long lanky growths defective in woody tissue. To secure these conditions free exposure to light and air is requisite, but in the case of coppice woods, or where long straight spars are needed by the forester, plants are allowed to grow thickly so as to ensure development in an upward rather than in a lateral direction. This and like matters will, however, be more fitly considered in dealing hereafter with the buds and their treatment.

Leaves.—The work of the leaves may briefly be stated to consist in the processes of nutrition and of respiration. Nutrition by the leaves includes the inhalation of moisture and of air, and of the combination, under the influence of light and in the presence of chlorophyll, the green colouring matter of plants, of carbon from the carbonic acid gas in the air with hydrogen from the watery vapour it contains, oxygen being exhaled. There is also a process of true respiration, in which atmospheric oxygen taken up by the leaves unites with a portion of the carbon in the plant, and is evolved as carbonic acid gas.

As a result of the processes carried on in the leaves under the influence of light, many of the secretions, as starch, sugar, oils, and colouring and odoriferous matters are formed. These either at once subserve the nutrition of the plant or are stored in its tissues, as in the case of

tubers and many seeds. Usually before it can be rendered available as nourishment the stored matter has to undergo a change from a more or less insoluble to a soluble form. The changes which they undergo within the plant require very careful study, and indeed constitute a department of physiology still very greatly in need of elucidation. Pringsheim's recent researches on the action of light on chlorophyll, prosecuted with the aid of a small lens and observed under the microscope, bid fair, if confirmed, materially to change the views of chemists as to the processes which go on in leaves as a consequence of exposure to light; but, although they may change or even reverse our notions as to the mode of action of chlorophyll, they will not detract from its importance.

Syringing, &c.—In certain circumstances water is absorbed by the surface of leaves, especially when the supply of moisture at the root is defective, and when by too long exposure to drought the watery constituents of the plant have evaporated. A certain amount of evaporation of superfluous watery fluid or vapour is a necessary accompaniment of nutrition, but this may easily become excessive, especially where the plant cannot readily recoup itself. In these circumstances such operations as "syringing" and "damping down" are of special value. Evaporating basins or tanks in houses for orchid and other plants are beneficial for like reasons. Following Boussingault and Henslow, by whom the absorption of water by leaves has been proved, we may sum up the advantages of syringing as follows:—it washes off dust and insects from the leaves, and by moistening the cuticle promotes respiration and the absorption of water; it checks loss by transpiration, and so enables terminal shoots and young

leaves to receive a sufficiency of sap from the stem ; it keeps the air cool by evaporation ; and lastly, as moisture is actually imbibed by the green parts of plants, it helps to compensate for any loss from within, and thus supplements root absorption.

In accordance with the facts just cited it is found that the preservation of cut flowers is promoted by inserting some of their leaves as well as their stalks in water. By cutting an herbaceous stem under water, so that the severed end is never exposed to the air, withering can to a large extent be prevented ; and a bouquet may be kept fresh for a long time either by immersing the whole in water, or by simply covering the vase of water in which it is placed with a bell-glass. In the case of "cuttings" excessive transpiration is obviated by means of bell-glasses and by shading, and sometimes by burying a portion of the cutting with a leaf attached.

Carnivorous Plants.—Before leaving the subject of nutrition by leaves, reference may be made to the so-called carnivorous plants, *e.g.*, *Drosera*. Substances, particularly such as contain nitrogen, as insects or fragments of meat, when brought into contact with the surface of the leaves, or with certain glands on the leaves, become dissolved by the agency of a digestive ferment secreted therein, are then absorbed and serve as nutriment.

Respiration, already alluded to, is not directly connected with exposure to light, since it goes on by night as freely as by day. It is a process essential to the life of the plant, and contributes to maintain its heat, to perfect its structure, to eliminate some of its secretions, and to destroy effete or impure matters. Chlorophyll, according to Pringsheim, acts as a regulator of the respiration of plants by

absorbing some of the luminous rays, and thereby favouring the function of assimilation.

Buds.—The recognition of the various forms of buds, and their modes of disposition in different plants, is a matter of the first consequence in the operations of pruning and training. Flower-buds may be produced on the old wood, *i.e.*, the shoots of the past year's growth, or on a shoot of the present year. The pear and rhododendron develop flower-buds for the next season speedily after blossoming, and these may be stimulated into premature growth. The peculiar short stunted branches or "spurs" which bear the flower-buds of the pear, apple, and their allies, and of the laburnum, deserve special attention. In the rose, in which the flower-buds are developed at the ends of the young shoot of the year, we have, on the other hand, an example of a plant destitute of flower-buds during the winter.

Propagation by Buds.—The detached leaf-buds (*gemmæ* or *bulbils*) of some plants are capable under favourable conditions of forming new plants. The edges of the leaves of *Bryophyllum calycinum* and of *Cardamine pratensis*, and the axils of the leaves of *Lilium bulbiferum* produce buds of this character. It is a matter of familiar observation that the ends of the shoots of brambles take root when bent down to the ground. In rare instances buds form on the roots, and may be used for purposes of propagation, as in the Japan quince. Of the tendency in buds to assume an independent existence gardeners avail themselves in the operations of striking "cuttings," and making layers and "pipings," as also in budding and grafting. In taking a slip or cutting the gardener removes from the parent plant one or more buds or "eyes," in the case of the vine one only, attached or not to a short shoot, and places them in a

moist and sufficiently warm situation, where, as previously mentioned, undue evaporation from the surface of the leaf or leaves is prevented. For some cuttings pots filled with light soil, with the protection of the propagating house and of bell-glasses, are requisite; but for many, such as willows, no such precautions are necessary, and the thrusting of the end of a shoot into moist ground suffices to ensure its growth. In the case of the more delicate plants, the formation of roots is preceded by the production from the cambium of the cuttings of a succulent mass of tissue, the *callus* covered by a thin layer of cork-cells. It is important in some cases to retain on the cutting some of its leaves, so as to supply the requisite food for storage in the callus. In other cases, where the buds themselves contain a sufficiency of nutritive matter for the young growths, the retention of leaves is not necessary. In the tissues of willow-stakes just referred to there exists an abundance of material available for the supply of the young roots. The most successful mode of forming roots is to place the cuttings in a mild bottom-heat, which expedites their growth, even in the case of many hardy plants whose cuttings strike roots in the open soil. With some hardwooded trees, as the common white-thorn, roots cannot be obtained without bottom-heat. As a rule throughout plant culture it is found better that the activity of the roots should be in advance of that of the leaves. Cuttings of deciduous trees and shrubs succeed best if planted early in autumn while the soil still retains the solar heat absorbed during summer. For evergreens April or May and August or September, and for greenhouse and stove-plants the spring and summer months, are the times most suitable for propagation by cuttings. The great object to be attained is to

secure the formation of active roots before the approach of winter.

Layering consists simply in bending down a branch and keeping it in contact with or buried to a small depth in the soil until roots are formed ; the connexion with the parent plant may then be severed. Many plants can be far more easily propagated thus than by cuttings.

Grafting or "*working*" consists in the transfer of a branch, the "graft" or "scion," from one plant to another, which latter is termed the "stock." The operation must be so performed that the growing tissues, or cambium-layer of the scion, may fit accurately to the corresponding layer of the stock. In *budding*, as with roses and peaches, a single bud only is implanted. *Inarching* is essentially the promotion of the union of one shoot to another of a different plant. The outer bark of each being removed, the two shoots are kept in contact by ligature until union is established, when the scion is completely severed from its original attachments. This operation is varied in detail according to the kind of plant to be propagated, but it is essential in all cases that the affinity between the two plants be close, that the union be neatly effected, and that the ratio as well as the season of growth of stock and scion be similar.

The selection of suitable stocks is a matter still requiring much scientific experiment. The object of grafting is to expedite and increase the formation of flowers and fruit. Strong-growing pears, for instance, are grafted on the quince stock in order to restrict their tendency to form "gross" shoots, and a superabundance of wood in place of flowers and fruit. Apples, for the same reason, are "worked" on the "paradise" or "doucin" stocks, which from

their influence on the scion are known as dwarfing stocks. Scions from a tree which is weakly, or liable to injury by frosts, are strengthened by engrafting on robust stocks. Lindley has pointed out that, while in Persia, its native country, the peach is probably best grafted on the peach, or on its wild type the almond, in England, the summer temperature of whose soil is much lower than that of Persia, it might be expected, as experience has proved, to be most successful on stocks of the native plum.

The soil on which the stock grows is a point demanding attention. From a series of careful experiments made in the Horticultural Society's Garden at Chiswick, it was found that where the soil is loamy, or light and slightly enriched with decayed vegetable matter, the apple succeeds best on the doucin stock, and the pear on the quince; and where it is chalky it is preferable to graft the apple on the crab, and the pear on the wild pear. For the plum on loamy soils the plum, and on chalky and light soils the almond, are the most desirable stocks, and for the cherry on loamy or light rich soils the wild cherry, and on chalk the "mahaleb" stock.

The form and especially the quality of fruit is more or less affected by the stock upon which it is grown. The Stanwick nectarine, so apt to crack and not to ripen when worked in the ordinary way, is said to be cured of these propensities by first inserting, close to the ground, a bud of the strong-growing *Magnum Bonum* plum on to the Brussels stock, and by then budding the nectarine on to the *Magnum Bonum* about a foot from the ground. The fruit of the pear is of a higher colour and smaller on the quince stock than on the wild pear; still more so on the medlar. On the mountain ash the pear becomes earlier.

The effects produced by stock on scion, and more particularly by scion on stock, are as a rule with difficulty appreciable. Nevertheless, in exceptional cases modified growths, termed "graft-hybrids," have been obtained which have been attributed to the commingling of the characteristics of stock and scion. Of these the most remarkable example is *Cytisus Adami*, a tree which year after year produces some shoots, foliage, and flowers like those of the common laburnum, others like those of the very different looking dwarf shrub *C. purpureus*, and others again intermediate between these. We may hence infer that *C. purpureus* was grafted or budded on the common laburnum, and that the intermediate forms are the result of graft-hybridization. Numerous similar facts have been recorded. Among gardeners the general opinion is against the possibility of graft-hybridization. The wonder, however, seems to be that it does not occur more frequently, seeing that fluids must pass from stock to scion, and matter elaborated in the leaves of the scion must certainly to some extent enter the stock. It is clear, nevertheless, from examination that as a rule the wood of the stock and the wood of the scion retain their external characters year by year without change. Still, as in the laburnum just mentioned, in the variegated jasmine, in *Abutilon Darwinii*, in the copper beech and in the horse-chestnut, the influence of a variegated scion has occasionally shown itself in the production from the stock of variegated shoots. At a meeting of the Scottish Horticultural Association (see *Gard. Chron.*, Jan. 10, 1880, fig. 12-14) specimens of a small roundish pear, the "Aston Town," and of the elongated kind known as "Beurré Clairgeau," were exhibited. Two more dissimilar pears hardly exist. The

result of working the Beurré Clairgeau upon the Aston Town was the production of fruits precisely intermediate in size, form, colour, speckling of rind, and other characteristics. Similar, though less marked, intermediate characters were obvious in the foliage and flowers.

Double grafting (French, *greffe sur greffe*) is sufficiently explained by its name. By means of it a variety may often be propagated, or its fruit improved in a way not found practicable under ordinary circumstances. For its successful prosecution prolonged experiments in different localities and in gardens devoted to the purpose are requisite.

Pruning, or the removal of superfluous growths, is practised in order to equalize the development of the different parts of trees, or to promote it in particular directions so as to secure a certain form, and, by checking undue luxuriance, to promote enhanced fertility. In the rose-bush, for instance, in which, as we have seen, the flower-buds are formed on the new wood of the year, pruning causes the old wood to "break," *i.e.*, to put forth a number of new buds, some of which will produce flowers at their extremities. The manner and the time in which pruning should be accomplished, and its extent, vary with the plant, the objects of the operation, *i.e.*, whether for the production of timber or fruit, the season, and various other circumstances. So much judgment and experience does the operation call for that it is a truism to say that bad pruning is worse than none. The removal of weakly, sickly, overcrowded, and gross infertile shoots is usually, however, a matter about which there can be few mistakes when once the habit of growth and the form and arrangement of the buds are known. Winter pruning is effected when the tree is comparatively at rest, and is therefore less liable to "bleeding" or outpouring of

sap. Summer pruning or pinching off the tips of such of the younger shoots as are not required for the extension of the tree, when not carried to too great an extent, is preferable to the coarser more reckless style of pruning. The injury inflicted is less and not so concentrated; the wounds are smaller, and have time to heal before winter sets in. The effects of badly-executed pruning, or rather hacking, are most noticeable in the case of forest trees, the mutilation of which often results in rotting, canker, and other diseases. Judicious and timely thinning so as to allow the trees room to grow, and to give them sufficiency of light and air, will generally obviate the need of the pruning-saw, except to a relatively small extent.

Training is a procedure adopted when it is required to grow plants in a limited area, or in a particular shape, as in the case of many plants of trailing habit. Judicious training also may be of importance as encouraging the formation of flowers and fruit. Growth in length is mainly in a vertical direction, or at least at the ends of the shoots; and this should be encouraged, in the case of a timber tree, or of a climbing plant which it is desired should cover a wall quickly; but where flowers or fruit are specially desired, then, when the wood required is formed, the lateral shoots may often be trained more or less downward to induce fertility. The refinements of training, as of pruning, may, however, be carried too far; and not unfrequently the symmetrically trained trees of the French excite admiration in every respect save fertility.

Sports or Bud Variations.—Here we may conveniently mention certain variations from the normal condition in the size, form, or disposition of buds or shoots on a given plant. An inferior variety of pear, for instance, may

suddenly produce a shoot bearing fruit of superior quality; a beech tree, without obvious cause, a shoot with finely divided foliage; or a camellia an unwontedly fine flower. When removed from the plant and treated as cuttings or grafts, such sports may be perpetuated. Many garden varieties of flowers and fruits have thus originated. The cause of their production is very obscure. In certain instances where plants have been "crossed" or hybridized, perhaps for generations, the phenomenon may be explained on the supposition of a dissociation of previously mixed elements, or of a reversion to some ancestral conditions.

Formation of Flowers.—Flowers, whether for their own sake or as the necessary precursors of the fruit and seed, are objects of the greatest concern to the gardener. As a rule they are not formed until the plant has arrived at a certain degree of vigour, or until a sufficient supply of nourishment has been stored in the tissues of the plant. The reproductive process of which the formation of the flower is the first stage being an exhaustive one, it is necessary that the plant, as gardeners say, should get "established" before it flowers. Moreover, although the green portions of the flower do indeed perform the same office as the leaves, the more highly coloured and more specialized portions, which are further removed from the typical leaf-form, do not carry on those processes for which the presence of chlorophyll is essential; and the floral organs may therefore, in a rough sense, be said to be parasitic upon the green parts. A check or arrest of growth in the vegetative organs seems to be a necessary preliminary to the development of the flower. The flower itself is always the modified extremity of a shoot or stalk,

which only exceptionally lengthens beyond the flower, as, for example, in "proliferous" roses.

A diminished supply of water at the root is requisite, so as to check energy of growth, or rather to divert it from leaf-making. Partial starvation will sometimes effect this ; hence the grafting of free-growing fruit trees upon dwarfing stocks, as before alluded to, and also the "ringing" or girdling of fruit trees, *i.e.*, the removal from the branch of a ring of bark, or the application of a tight cincture, in consequence of which the growth of the fruits above the wound or the obstruction is enhanced. On the same principle the use of small pots to confine the roots, root-pruning and lifting the roots, and exposing them to the sun, as is done in the case of the vine in some countries, are resorted to. A higher temperature, especially with deficiency of moisture, will tend to throw a plant into a flowering condition. This is exemplified by the fact that the temperature of the climate of Great Britain is too low for the flowering, though sufficiently high for the growth of many plants. Thus the Jerusalem artichoke, though able to produce stems and tubers abundantly, only flowers in exceptionally hot seasons.

Forcing.—The operation of forcing is based upon the facts just mentioned. By subjecting a plant to a gradually increasing temperature, and supplying water in proportion, its growth may be accelerated ; its season of development may be, as it were, anticipated ; it is roused from a dormant to an active state. Forcing therefore demands the most careful adjustment of temperature and of supplies of moisture and light.

Deficiency of light is less injurious than might at first be expected wherever the plant to be forced has stored up

in its tissues, and available for use, a reserve stock of material formed through the agency of light in former seasons. The intensity of the colour of flowers and the richness of flavour of fruit are, however, deficient where there is feebleness of light. Recent experiments of Dr Siemens have shown that the gardener may avail himself of the electric light, which is proved to exercise on chlorophyll the same kind of influence as do the solar rays, and that he may thus supply the deficiencies of natural illumination. The employment of that light for forcing purposes would seem to be at present a question of expense. The great advantage hitherto obtained from its use has consisted in the rapidity with which flowers have been formed and fruits ripened under its influence, circumstances which go towards compensating for the extra cost of production.

Double Flowers.—The taste of the day demands that “double flowers” should be largely grown. Though in some instances, as in hyacinths, they are decidedly less beautiful than single ones, they present the advantage of being less evanescent. Under the vague term “double” many very different morphological changes are included. The flower of a double dahlia, *e.g.*, offers a totally different condition of structure from that of a rose or a hyacinth. The double poinsettia, again, owes its so-called double condition merely to the increased number of its scarlet involucral leaves, which are not parts of the flower at all. It is reasonable, therefore, to infer that the causes leading to the production of double flowers are varied. A good deal of difference of opinion exists as to whether they are the result of arrested growth or of exuberant development, and accordingly whether restricted


food or abundant supplies of nourishment are the more necessary for their production. It must suffice here to say that double flowers are most commonly the result of the substitution of brightly-coloured petals for stamens or pistils or both, and that a perfectly double flower where all the stamens and pistils are thus metamorphosed is necessarily barren. Such a plant must needs be propagated by cuttings. It rarely happens, however, that the change is quite complete throughout the flower, and so a few seeds may be formed, some of which may be expected to reproduce the double-blossomed plants. By continuous selection of seed from the best varieties, and "roguing" or eliminating plants of the ordinary type, a "strain" or race of double flowers is gradually produced.

Formation of Seed—Fertilization.—In fertilization—the influence in flowering plants of the sperm-cell, or its contents upon the germ-cell—there are many circumstances of importance horticulturally, to which therefore brief reference must be made. Flowers, generally speaking, are either self-fertilized, cross-fertilized, or hybridized. Self-fertilization occurs when the pollen of a given flower affects the germ-cell of the same individual flower. Such a flower is hermaphrodite functionally as well as structurally. In self-fertilizing flowers the structure is such that the pollen inevitably comes in contact with the stigma; but fertilization is also dependent on the simultaneous maturity of pollen and stigma. Cross-fertilization varies both in manner and degree. In the simplest instances the pollen of one flower fertilizes the ovules of another on the same plant, owing to the stamens arriving at maturity in any one flower earlier or later than the pistils. Such flowers though structurally hermaphrodite are, at any given time,

functionally unisexual. In many plants a polymorphic condition occurs; thus, in the same species of primrose some flowers have the stamens short, and within the tube of the corolla, with the style projecting beyond the mouth, giving the appearance termed "pin-eyed," while others known as "thrum-eyed," present exactly reverse conditions of stamens and style. In the common loose-strife, *Lythrum Salicaria*, the stamens are of three lengths, and the styles differ correspondingly. In such di- or tri-morphic flowers, as Mr Darwin's experiments have shown, the most complete fertility occurs when a cross is effected between a flower having short stamens and one with short styles. It is asserted that, not only is such a union more fertile than when pollen from a short stamen is placed on a long style, or *vice versa*, but the seedling plants are as a rule more vigorous.

Cross-fertilization must of necessity occur when the flowers are structurally unisexual, as in the hazel, in which the male and female flowers are monœcious, or separate on the same plant, and in the willow, in which they are diœcious, or on different plants. A conspicuous example of a diœcious plant is the common aucuba, of which for years only the female plant was known in Britain. When, through the introduction of the male plant from Japan, its fertilization was rendered possible, ripe berries, before unknown, became common ornaments of the shrub.

The conveyance of pollen from one flower to another in cross-fertilization is effected naturally by the wind, or by the agency of insects and other creatures. Flowers that require the aid of insects usually offer some attraction to their visitors in the shape of bright colour, fragrance, or sweet juices. The colour and markings of a flower often



serve to guide the insects to the honey, in the obtaining of which they are compelled either to remove or to deposit pollen. The reciprocal adaptations of insects and flowers demand attentive observation on the part of the gardener concerned with the growing of grapes, cucumbers, melons, and strawberries, or with the raising of new and improved varieties of plants. Scarcely less remarkable, though not so important in the present connexion, are the means by which the visits of such insects as are useless for the purpose of fertilization, or even injurious to the plant, as preying without advantage to it on its secretions, are prevented or rendered ineffective. In wind-fertilized plants the flowers are comparatively inconspicuous and devoid of many attractions for insects; and their pollen-cells are smoother and smaller, and better adapted for transport by the wind, than those of insect-fertilized plants, the roughness of which adapt them for attachment to the bodies of insects.

Although the general facts with respect to fertilization are as above stated, it must be remembered that probably self-fertilization is not constant in any plant under all circumstances, and that it certainly does sometimes take place in flowers which are usually cross-fertilized. It may be that, while continued self-fertilization ensures the perpetuation of certain qualities, cross-fertilization induces beneficial variation. Some botanists doubt the injurious effects attributed to self-fertilization, and, so long as a plant is healthy, it can be attended with but little disadvantage; but after a time in any case a cross is probably useful, and sometimes fertility is found to be much greater, and in some instances, only possible, when impregnation is not produced by a flower's own stamens.

It is very probable that the same flower at certain times and seasons is self-fertilizing, and at others not so. The defects which cause gardeners to speak of certain vines as "shy setters," and of certain strawberries as "blind," may be due either to unsuitable conditions of external temperature, or to the non-accomplishment, from some cause or other, of cross-fertilization. In a vinery or a peach-house it is often good practice at the time of flowering to tap the branches smartly with a stick so as to ensure the dispersal of the pollen. Sometimes more delicate and direct manipulation is required, and the gardener has himself to convey the pollen from one flower to another, for which purpose a small camel's-hair pencil is generally suitable. The degree of fertility varies greatly according to external conditions, the structural and functional arrangements just alluded to, and other causes which may roughly be called constitutional. Thus, it often happens that an apparently very slight change in climate alters the degree of fertility. Certain plants which seem almost sterile with their own pollen become fertile if grafted on some others. In a particular country or at certain seasons one flower will be self-sterile or nearly so, and another just the opposite. The influence of conditions on the formation of "races," and the consequent importance to the horticulturist seeking to obtain new and improved strains of crossing-plants grown in different localities, have been specially insisted on by Darwin. The advantages of this practice are analogous to those accruing from what gardeners call "change of seed," i.e., the sowing of seed or the planting of tubers, say of potatoes, in localities and on soils other than those in which they themselves were produced.

Hybridization.—Some of the most interesting results and

many of the gardener's greatest triumphs have been obtained by hybridization, *i.e.*, the crossing two individuals, not of the same but of two distinct species of plants, as, for instance, two species of rhododendron or two species of orchid. It is obvious that hybridization differs more in degree than in kind from cross-fertilization. The occurrence of hybrids in nature explains the difficulty experienced by botanists in deciding on what is a species, and the widely different limitations of the term adopted by different observers in the case of willows, roses, brambles, &c. The artificial process is practically the same in hybridization as in cross-fertilization, but usually requires more care. To prevent self-fertilization, or the access of insects, it is advisable to remove the stamens and even the corolla from the flower to be impregnated, as its own pollen or that of a flower of the same species is often found to be "prepotent." There are, however, cases, *e.g.*, some passion-flowers and rhododendrons, in which a flower is more or less sterile with its own, but fertile with foreign pollen, even when this is from a distinct species. It is a singular circumstance that reciprocal crosses are not always or even often possible; thus, one rhododendron may afford pollen perfectly potent on the stigma of another kind, by the pollen of which latter its own stigma is unaffected. With respect to the relations of the hybrid offspring, which partakes sometimes more of the characteristics of the male or pollen parent, sometimes more of those of the female or seed-parent, the opinions of practical experimenters are so diverse that at present no general rule can be established. A valuable essay on the subject is the presidential address read by Mr Anderson-Henry at the annual meeting of the Botanical Society of Edinburgh in 1867. A general *résumé* of the facts will be

found in Darwin's *Origin of Species*, his *Variations of Animals and Plants under Domestication*, and his works on the fertilization of flowers.

The object of the hybridizer is to obtain varieties exhibiting improvements in hardihood, vigour, size, shape, colour, fruitfulness, or other attributes. His success depends not alone on skill and judgment, for some seasons, or days even, are found more propitious than others. Although promiscuous and hap-hazard procedures no doubt meet with a measure of success, the best results are those which are attained by systematic work with a definite aim. To secure early and free-flowering varieties, Mr Henry advises "violent" crosses, *i.e.*, crosses between varieties or species as distantly related as is practicable. Careful experiments are still greatly needed for the elucidation of the mysteries and the development of the resources of hybridization. It is difficult to understand why some very closely-related species, *e.g.*, the apple and pear, the currant and gooseberry, refuse to intercross, while much more remote species, or even members of different genera, can be made to do so, as in the case of the hybrid *Philageria* (see *Gardeners' Chronicle*, 1872, p. 358), which is the result of a cross between the climbing plant *Lapageria rosea* and the dwarf bush *Philesia buxifolia*.

Hybrids are usually less fertile than pure-bred species, and are occasionally quite sterile. Some hybrids, however, are as fertile as pure-bred plants. Hybrid plants may be again crossed, or even re-hybridized, so as to produce a progeny of very mixed parentage. This is the case with many of our roses, dahlias, begonias, pelargoniums, and other long or widely cultivated garden plants.

Reversion.—In modified forms of plants there is fre-

quently a tendency to "sport" or revert to parental or ancestral characteristics. So markedly is this the case with hybrids that in a few generations all traces of a hybrid origin may disappear. The dissociation of the hybrid element in a plant must be obviated by careful selection.

Germination.—The length of the period during which seeds remain dormant after their formation is very variable. The conditions for germination are much the same as for growth in general. Access to light is not required, because the seed contains a sufficiency of stored-up food. The temperature necessary varies according to the nature and source of the seed. Some seeds require prolonged immersion in water to soften their shells; others are of so delicate a texture that they would dry up and perish if not kept constantly in a moist atmosphere. Seeds buried too deeply receive a deficient supply of air. As a rule, seeds require to be sown more deeply in proportion to their size and the lightness of the soil.

The time required for germination in the most favourable circumstances varies very greatly, even in the same species, and in seeds taken from one pod. Thus the seeds of *Primula japonica*, though sown under precisely similar conditions, yet come up at very irregular intervals of time. Germination is often slower where there is a store of available food in the perisperm or albumen, or in the embryo itself, than where this is scanty or wanting. In the latter case the seedling has early to shift for itself, and to form roots and leaves for the supply of its needs.

Selection.—Supposing seedlings to have been developed, it is found that a large number of them present considerable variations, some being especially robust, others peculiar in size or form. Those most suitable for the purpose of

the gardener are carefully selected for propagation, while others not so desirable are destroyed; and thus after a few generations a fixed variety, race, or strain superior to the original form is obtained. Many garden plants have originated solely by selection; and it is certain that, quite independently of cross-breeding, much could still be done to improve our breeds of vegetables, flowers, and fruit by more systematic selection. The remarkable results obtained in the case of Major Hallett's pedigree wheat and Mr Bennett's hybrid tea-roses are instances in point. Two robust-growing varieties of potato, the "Magnum Bonum" and the "Champion," have been found to resist better than others the attacks of fungus to which the plant is liable. Whatever may be the cause, whether the possession by the tuber or haulm of a more than ordinarily thick skin, or other peculiarity, it is obvious that selection with a view to the development of this quality might be productive of the most important results. Darwin recommends, as a means of improving health and fertility by intercrossing without loss of purity of race, to sow in alternate rows seeds grown under as different conditions as possible.

Large and well-formed seeds are to be preferred for harvesting. The seeds should be kept in sacks or bags in a dry place, and if from plants which are rare, or liable to lose their vitality, they are advantageously packed for transmission to a distance in bottles or jars filled with earth or sphagnum moss, without the addition of moisture. Cuttings and entire plants may be transported in wide-mouthed bottles.

It will have been gathered from what has been said that seeds cannot always be depended on to reproduce exactly

the characteristics of the plant which yielded them ; for instance, seeds of the greengage plum or of the Ribston pippin will produce a plum or an apple, but not these particular varieties, to perpetuate which grafts or buds must be employed.



PART II.

PRACTICE OF GARDENING.



THE details of horticultural practice naturally range under the three heads of Flowers, Fruits, and Vegetables. There are, however, certain general aspects of the subject which will be more conveniently noticed apart, since they apply alike to each department. We shall therefore first treat of these under the following headings:—Formation and Preparation of the Garden, Garden Structures and Edifices, Garden Materials and Appliances, and Garden Operations.

CHAPTER II.

FORMATION AND PREPARATION OF THE GARDEN.

Site.—The site chosen for the mansion will more or less determine that of the garden, the pleasure grounds and flower garden being placed so as to surround or lie contiguous to it, while the fruit and vegetable gardens, either together or separate, should be placed on one side or in the rear, according to fitness as regards the nature of the soil and subsoil, the slope of the surface, or the general features of the park scenery. In the case of villa gardens there is usually little choice: the land to be occupied is cut up into plots, usually rectangular, and of greater or less breadth, and in laying out these plots there is generally a smaller space left in the front of the villa residence and a larger one

behind, the front plot being mostly devoted to approaches, shrubbery, and plantations, flower beds being added if space permits, while the back or more private plot has a piece of lawn grass with flower beds next the house, and a space for vegetables and fruit trees at the far end, this latter being shut off from the lawn by an intervening screen of ever-greens. Between these two classes of gardens there are many gradations, but as including the smaller, our remarks will chiefly apply to those of larger extent.

The almost universal practice is to have the fruit and vegetable gardens combined; and the flower garden may sometimes be conveniently placed in juxtaposition with them. When the fruit and vegetable gardens are combined, the smaller and choicer forms of fruit trees only should be admitted, larger-growing hardy trees, such as apples, pears, plums, cherries, &c., being relegated to the orchard.

Ground possessing a gentle inclination toward the south is desirable for a garden. On such a slope effectual draining is easily accomplished, and the greatest possible benefit is derived from the sun's rays. It is well also to have an open exposure towards the east and west, so that the garden may enjoy the full benefit of the morning and evening sun, especially the latter; but shelter is desirable on the north and north-east, or in any direction in which the particular locality may happen to be exposed.

Soil and Subsoil.—A hazel-coloured loam, moderately light in texture, is well-adapted for most garden crops, whether of fruits or culinary vegetables, especially a good warm deep loam resting upon chalk; and if such a soil occurs naturally in the selected site, but little will be required in the way of preparation. If the soil is not moderately good and of fair depth, the situation is not an

eligible one for gardening purposes. Wherever the soil is not quite suitable, but is capable of being made so, it is best to remedy the defect at the outset; and as it will be found easier to render a light soil sufficiently retentive than to make a tenacious clay sufficiently porous, a light soil is to be preferred to one which is excessively stiff and heavy. It is advantageous to possess a variety of soils; and if the garden be on a slope, it will often be practicable to render the upper part light and dry, while the lower retains a heavier and damper character.

Natural soils consist of substances derived from the decomposition of various kinds of rocks, the bulk consisting of clay, silica, and lime, in various proportions. As regards preparation, draining is of course of the utmost importance. The ground should also be trenched to the depth of 3 feet at least, but the deeper the better, provided the good soil be not buried under a mass of inferior quality. In this operation all stones larger than a man's fist must be taken out, and all roots of trees and of perennial weeds carefully cleared away. When the whole ground has been thus treated, a moderate liming will, in general, be useful. After this, supposing the work to have occupied most of the summer, the whole may be laid up in ridges, to expose as great a surface as possible to the action of the winter's frost.

Argillaceous or clay soils are those which contain a large percentage (45-50) of clay, and a small percentage (5 or less) of lime. These are unfitted for garden purposes until improved by draining, liming, trenching, and the addition of porous materials, such as ashes, burnt ballast, or sand, but when thoroughly improved they are very fertile and less liable to become exhausted than most other soils. Loamy soils contain a considerable quantity (30-45 per cent.) of clay, and smaller quantities (5 or less) of lime and humus. Such soils properly drained and prepared are very suitable for orchards, and when the proportion of clay is smaller (20-30 per cent.) they

form excellent garden soils, in which the better sort of fruit trees luxuriate. Marly soils are those which contain a considerable percentage (10–20) of lime, and are called clay marls, loamy marls, and sandy marls, according as these several ingredients preponderate. The clay marls are, like clay soils, too stiff for garden purposes until ameliorated; but loamy marls are fertile and well suited to fruit trees, and sandy marls are adapted for producing early crops. Calcareous soils, which may also be heavy, intermediate, or light, are those which contain more than 20 per cent. of lime, their fertility depending on the proportions of clay and sand which enter into their composition; they are generally cold and wet. Vegetable soils or moulds, or humus soils, contain a considerable percentage (more than 5) of humus, and embrace both the rich productive garden moulds and those known as peaty soils.

The nature of the subsoil is of scarcely less importance than that of the surface soil. If an unsuitable subsoil has to be dealt with, it must be removed or ameliorated. An uneven subsoil, especially if retentive, is most undesirable, as water is apt to collect in the hollows, and thus affect the upper soil. The remedy is to make the plane of its surface agree with that of the ground. When there is a hard pan this should be broken up, and if of bad quality the material should be removed altogether. When there is an injurious preponderance of metallic oxides or other deleterious substances, the roots of trees would be affected by them, and they must therefore be removed. When the subsoil is too compact to be pervious to water, effectual drainage must be resorted to; when it is very loose, so that it drains away the fertile ingredients of the soil as well as those which are artificially supplied, the compactness of the stratum must be increased. The best of all subsoils is a dry bed of clay overlying sandstone.

Size and Form.—The general size of a garden adjoining a mansion is from 4 to 6 acres; but in many places the extent varies from 12 to 20 or even 30 acres. A garden of 2

to 3 acres, enclosed by walls and surrounded by slips, will, however, suffice for the supply of a moderate establishment.

In laying out the garden, the plan should be prepared in minute detail before commencing operations. The form of the kitchen and fruit garden should be square or oblong, rather than curvilinear, since the working and cropping of the ground can thus be more easily carried out. The whole should be compactly arranged, so as to facilitate working, and to afford convenient access for the carting of the heavy materials. This access is especially desirable as regards the store-yards and framing ground, where fermenting manures and tree leaves for making up hot beds, coals or wood for fuel, and ingredients for composts, together with flower pots and the many necessities of garden culture, have to be accommodated. In the case of villas or picturesque residences, gardens of irregular form may be permitted; when adapted to the conditions of the locality, they associate better with surrounding objects, but in such gardens wall space is usually limited.

The distribution of the garden area in walks, borders, and compartments must be partly regulated by the outline of the ground. In general, a gravel walk, 6 or 8 feet broad, is led quite round the garden, both within and without the walls. A walk of similar dimensions is often constructed in the centre of the garden in the direction of the glazed houses, and this is sometimes crossed by another at right angles, which is far preferable to having the walks led diagonally from the corners, since this throws the enclosed plots out of the square. The space between the wall and the walk that skirts it is called the wall-border, and is commonly from 15 to 20 feet broad. On the interior of the walk there is usually another border 5 or 6 feet broad,

which is generally occupied by fruit trees, trained either as espaliers, as dwarfs, or as pyramids. The middle part of the garden is divided into rectangular compartments for raising the various culinary crops. It is advantageous to have several small beds, in which to cultivate the less bulky subjects, such as herbs, annual or perennial, which, in large spaces, are apt to be overlooked or neglected.

A considerable portion of the north wall is usually covered in front with the glazed structures called forcing-houses, and to these the houses for ornamental plants are sometimes attached; but a more appropriate site for the latter is the flower garden, when that forms a separate department. It is well, however, that everything connected with the forcing of fruits or flowers should be concentrated in one place. The frame ground, including melon and pine pits, should occupy some well-sheltered spot in the slips, or on one side of the garden, and adjoining to this may be found a suitable site for the compost ground, in which the various kinds of soils are kept in store, and in which also composts may be prepared.

As the walls afford valuable space for the growth of the choicer kinds of hardy fruits, the direction in which they are built is of considerable importance. In the warmer parts of the country the wall on the north side of the garden should be so placed as to face the sun at about an hour before noon, or a little to the east of south; in less favoured localities it should be made to face direct south, and in still more unfavourable districts it should face the sun an hour after noon, or a little west of south. The east and west walls should run parallel to each other, and at right angles to that on the north side, in all the most favoured localities; but in colder or later ones, though parallel,

they should be so far removed from a right angle as to get the sun by eleven o'clock. On the whole, the form of a parallelogram with its longest sides in the proportion of about five to three of the shorter, and running east and west, may be considered the best form, since it affords a greater extent of south wall than any other. Mr Thompson, in the *Gardener's Assistant*, gives a figure which is nearly in this proportion (fig. 1), representing a small garden $272\frac{1}{2}$ feet by 160, and therefore containing exactly an acre. This figure admits of nearly double the number of trees on the south aspect as compared with the east and

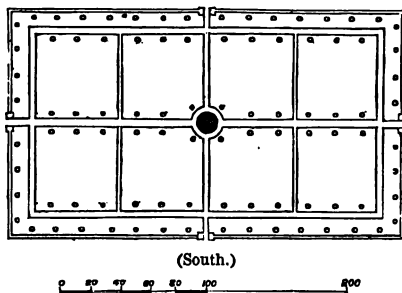


FIG. 1.—Plan of Garden an acre in area.

west; it allows a greater number of espalier or pyramid trees to face the south; and it admits of being divided into equal principal compartments, each of which forms nearly a square. The size of course can be increased to any requisite extent. That of the royal gardens at Frogmore, 760 feet from east to west, and 440 feet from north to south, is nearly of the same proportions.

The spaces between the walls and the outer fence are called slips. A considerable extent is sometimes thus enclosed, and utilized for the growth of such vegetables as potatoes, winter greens, and sea-kale, for the small bush fruits, and for strawberries. The slips are also convenient as affording a variety of aspects, and thus helping to prolong the season of particular vegetable crops.

Shelter.—A screen of some kind to temper the fury of the blast is absolutely necessary. If the situation is not naturally well sheltered, the defect may be remedied by masses of forest trees disposed at a considerable distance so as not to shade the walls or fruit trees. They should not be nearer than say 50 yards, and may vary from that to 100 or 150 yards distance according to circumstances, regard being had especially to peculiarities occasioned by the configuration of the country, as for instance to aerial currents from adjacent eminences. Care should be taken, however, not to hem in the garden by crowded plantations, shelter from the prevailing strong winds being all that is required, while the more open it is in other directions the better. The trees employed for screens should include both those of deciduous and of evergreen habit, and should suit the peculiarities of local soil and climate. Of deciduous trees the sycamore, wych-elm, horse-chestnut, beech, lime, plane, and poplar may be used,—the *Populus canadensis nova* being one of the most rapid-growing of all trees, and, like other poplars, well-suited for nursing choicer subjects ; while of evergreen trees, the holm oak, holly, laurel (both common and Portugal), and such conifers as the Scotch, Weymouth, and Austrian pines, with spruce and silver firs and yews, may be used if the soil is suitable. The conifers make the most effective screens.

Extensive gardens in exposed situations are often divided into compartments by hedges, so disposed as to break the force of high winds. Where these are required to be narrow as well as lofty, holly, yew, or beech is to be preferred ; but, if there is sufficient space, the beautiful cherry-laurel and the noble bay may be employed where they will thrive. Smaller hedges may be formed of ever-

green privet, or of tree-box. These subordinate divisions furnish, not only shelter, but also shade, which, at certain seasons, is peculiarly valuable.

Belts of shrubbery may be placed round the slips outside the walls ; and these may in many cases, or in certain parts, be of sufficient breadth to furnish pleasant retired promenades, at the same time that they serve to mask the formality of the walled gardens, and are made to harmonize with the picturesque scenery of the pleasure ground.

Water Supply.—Although water is one of the most important elements in vegetable life, we do not find one garden in twenty where even ordinary precautions have been taken to secure a competent supply. Rain-water is the best, next to that river or pond water, and last of all that from springs ; indeed, a chemical analysis should be made of the last before introducing it, as some spring waters contain mineral ingredients injurious to vegetation. Iron pipes are the best conductors ; they should lead to a capacious open reservoir placed outside the garden, and at the highest attainable level, in order to secure sufficient pressure for effective distribution, and to permit that the wall trees may be effectually washed. Stand pipes should be placed at intervals beside the walks and in other convenient places from which water may at all times be drawn ; and short flexible tubes should be made to fit on to them, to which a garden hose can be attached, so as to permit of the whole garden being readily and when necessary profusely watered. The mains should be placed under the walks out of reach of frost, and so that they may be easily got at when repairs are required. Pipes should also be laid having a connexion with all the various greenhouses and forcing-houses, each of which should be provided with

a cistern for aerating the daily supplies. In fact, every part of the garden, including the working sheds and offices, should have water supplied without stint. At the same time it is not expedient to admit of large basins or ponds, and far less of a running stream in a garden.

Approach and Fence.—The entrance to the garden from without is a matter requiring the exercise of some taste and of sound judgment. If possible, it should be from the south and front, so that the pleasing effect of the range of glazed houses may be realized by the visitor on entering. Sometimes a lateral entrance, leading from the flower-garden through an intermediate shrubbery, and coming upon the hot-houses in flank, may be necessary. The worst of all entrances is from the back or north, everything being then viewed in reverse.

All gardens of large extent should be encircled by an outer boundary, which is often formed by a sunk wall or ha-ha surrounded by an invisible wire fence to exclude ground game, or consists of a hedge with low wire fence on its inner side. Occasionally this sunk wall is placed on the exterior of the screen plantations, and walks lead through the trees, so that views are obtained of the adjacent country. Although the interior garden receives its form from the walls, the ring fence and plantations may be adapted to the shape and surface of the ground. In smaller country gardens the enclosure or outer fence is often a hedge, and there is possibly no space enclosed by walls, but some divisional wall having a suitable aspect is utilized for the growth of peaches, apricots, &c., and the hedge merely separates the garden from a paddock used for grazing. The still smaller gardens of villas are generally bounded by a wall or wood fence, the inner side of which

is appropriated to fruit trees. For the latter, walls are much more convenient and suitable than a boarded fence, but in general these are too low to be of much value as aids to cultivation, and they are best covered with bush fruits or with ornamental plants of limited growth.

Walks and Edgings.—The best material for the construction of garden walks is good binding gravel. The ground should be excavated to the depth of a foot or more,—the bottom being made firm and slightly concave, so that it may slope to the centre, where a drain should be introduced; or the bottom may be made convex and the water allowed to drain away at the sides. The bottom 9 inches should be filled in compactly with hard coarse materials, such as stones, brickbats, clinkers, burned clay, &c., on which should be laid two or three inches of coarse gravel, and then an inch or two of firm binding gravel on the surface. The surface of the walks should be kept well rolled, for nothing contributes more to their elegance and durability.

All the principal lines of walk should be broad enough to allow at least three persons to walk abreast; the others may be narrower, but a multitude of narrow walks has a puny effect. Much of the neatness of walks depends upon the material of which they are made. Gravel from an inland pit is to be preferred; though occasionally very excellent varieties are found upon the sea-coast. The gravels of the neighbourhood of London have attained considerable celebrity, and have been frequently employed in remote parts of the kingdom, the expense being lessened by their being conveyed to different sea-ports as ballast for ships. Gravel walks must be kept free from weeds, either by hand weeding, by occasionally strewing salt on the surface, or by watering with dilute acids. In some parts of the country the best

available material does not bind to form a close even surface, and such walks are kept clean by hoeing.

Grass walks were common in English gardens during the prevalence of the Dutch taste, but, owing to the frequent humidity of the climate, they have in a great measure been discarded. Their disuse is perhaps to be regretted, as in some situations, particularly behind lengthened screens of trees, they form very agreeable promenades in dry, hot weather. Grass walks were made in the same way as grass lawns. When the space to be thus occupied had been prepared, a thin layer of sand or poor earth was laid upon the surface, and over this a similar layer of good soil. This arrangement was adopted in order to prevent excessive luxuriance in the grass.

Edgings.—Walks are separated from the adjoining beds and borders in a variety of ways. If a living edging is adopted, by far the best is afforded by the dwarf Dutch box planted closely in line. It is of extremely neat growth, and, when annually clipped, will remain in good order for many years. Very good edgings, though less neat and durable, are formed by thrift (*Statice Armeria*), double daisy (*Bellis perennis*), gentianella (*Gentiana acaulis*), and London pride (*Saxifraga umbrosa*), or any low-growing evergreen herb, susceptible of minute division. The finer grasses carefully selected, such as the sheep's fescue (*Festuca ovina*) or its glaucous variety, form elegant edgings if frequently replanted, and the culms kept pulled away. Edgings may also be formed of narrow slips of sandstone flag, slate, fire-clay tiles, bricks, glass, or cast-iron. An excellent form of edging tile is that invented by Mr Stevens of Trentham Gardens (fig. 2), which is made of a durable kind of clay, and is very neat in appearance. It is 18 inches long, 5

inches deep, and 5 inches broad, and, resting on the broad base, is held firmly by the gravel used for filling up the walk. One advantage of using edgings of this kind, especially in kitchen gardens, is that they do not harbour slugs and similar vermin, which all live edgings do, and often to a serious extent, if they are left to grow large. In shrubberies and large flower-plots, verges of grass-turf,

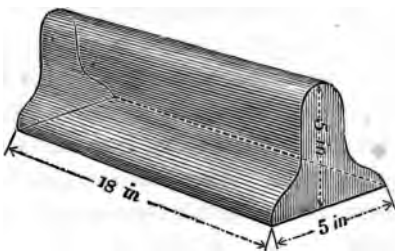


FIG. 2.—Stevens's Edging Tile.

from 1 to 3 feet in breadth, according to the size of the border and width of the walk, make a very handsome edging, but they should not be allowed to rise more than an inch and a half above the gravel, the grass being kept short by repeated mowings, and the edges kept trim and well-defined by frequently clipping with shears, and cutting once a year with an edging iron.

CHAPTER III.

GARDEN STRUCTURES.



THE gardener's residence and the apartments for the workmen should be within convenient distance of each other, and of the forcing-houses. The gardener's house may stand in the centre of the range of hot-houses, or it may be placed in one corner of the walled garden. In either case it should communicate on the one side with the best part of the garden, and on the other with the yard in which the garden offices are placed.

Walls.—The position to be given to the garden walls has been already referred to at page 55. The shelter afforded by a wall, and the increased temperature secured by its presence, are indispensable in the climate of Great Britain, for the production of all the finer kinds of outdoor fruits; and hence, the inner side of a north wall, having a southern aspect, is appropriated to the more tender kinds. It is, indeed, estimated that such positions enjoy an increased temperature equal to 7° of latitude; that is to say, the mean temperature within a few inches of the wall is equal to the mean temperature of the open plain 7° farther south. The eastern and western aspects are set apart for fruits of a somewhat harder character.

Where the inclination of the ground is considerable, and the presence of high walls would be objectionable, the latter

may be replaced by sunk walls. These should not rise more than 3 feet above the level of the ground behind them. As dryness is favourable to an increase of heat, such walls should be either built hollow, or packed behind to the thickness of 3 or 4 feet with rubble stones, flints, brickbats, or similar material, thoroughly drained at bottom. For mere purposes of shelter a height of 6 or 7 feet will generally be sufficient for the walls of a garden, but for the training of fruit trees it is found that an average height of 12 feet is most suitable. In gardens of large size the northern or principal wall may be 14 feet, and the side walls 12 feet in height; while smaller areas of an acre or so may have the principal walls 12 and the side walls 10 feet in height. As brick is more easily built hollow than stone, it is to be preferred for garden walls. A 14-inch hollow wall will take in its construction 12,800 bricks, while a solid 9-inch one, with piers, will take 11,000; but the hollow wall, while thus only a little more costly, will be greatly superior, being drier and warmer, as well as more substantial. Bricks cannot be too well burnt for garden walls; the harder they are the less moisture will they absorb. The darker colour they acquire when the process of burning

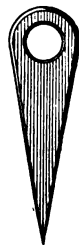


FIG. 3.—Cast-Iron Wall Stud.

is prolonged is also more in harmony with the surrounding objects. At one time brick walls were preferred on account of the facility they afforded for nailing in the trees, but now cast-iron studs (fig. 3), or sometimes nails, are placed in the wall during its erection, being pushed into the joints before the mortar becomes set, and ranged in straight lines, both vertically and horizontally; for

peaches, &c., they are placed 9 inches apart, and for pears, &c., 15 inches. The trees are fastened to them by soft ligatures of twine or matting, which should be twisted after being tied to the stud or nail, so as to prevent contact between the branch and the metal. Many excellent walls are built of stone. The best is dark-coloured whinstone, because it absorbs very little moisture, or in Scotland Caithness pavement 4 inches thick. The stones can be cut (in the quarries) to any required length, and built in regular courses. Stone walls should always be built with thin courses for convenience of training over their surface. Concrete walls, properly coped and provided with a trellis, may in some places be cheapest, and they are very durable. Common rubble walls are the worst of all.

The coping of garden walls is important, both for the preservation of the walls and for throwing the rain-water off their surfaces. It should not project less than from 2 to 2½ inches, but in wet districts may be extended to 6 inches. Stone copings are best, but they are costly, and Portland cement is sometimes substituted. Temporary copings of wood, which may be fixed by means of permanent iron brackets just below the stone coping, are extremely useful in spring for the protection of the blossoms of fruit trees. They should be 9 inches or a foot wide, and should be put on during spring before the blossom buds begin to expand; they should have attached to them scrim cloth (a sort of thin canvas), which admits light pretty freely, yet is sufficient to ward off ordinary frosts; this canvas is to be let down towards evening, and drawn up again in the morning. These copings should be removed when they are of no further utility as protectors, so that the foliage may have the full benefit of rain and

dew. Any contrivance that serves to interrupt radiation, though it may not keep the temperature much above freezing, will be found sufficient. Standard fruit trees must be left to take their chance ; and, indeed, from the lateness of their flowering, they are generally more injured by blight, and by drenching rains which wash away the pollen of the flowers, than by the direct effects of cold.

Hot walls, whether constructed to be warmed by flues or hot-water pipes, are nearly or quite obsolete. Their chief use is to assist in ripening the young wood, and the crops of late varieties of tender fruits, by the aid of artificial heat, but the extra cost of heating them would perhaps be more usefully directed to the construction of a glazed house for the same purposes.

Espalier Rails.—Subsidiary to walls as a means of training fruit trees, espalier rails were formerly much employed, and are still used in many gardens. In their simplest form, they are merely a row of slender stakes of larch or other wood driven into the ground, and connected by a slight rod or fillet at top. The use of iron rails has now been almost wholly discontinued, since they act as powerful conductors of both heat and cold in equal extremes, and thus injure the branches. Trees trained to espalier rails have some advantages, as they are easily got at for all cultural operations, space is saved, and the fruit, while freely exposed to sun and air, is tolerably secure against wind. They form, moreover, neat enclosures for the vegetable quarters, and are productive in soils and situations which are suitable.

Plant Houses.—These include all those structures which are more intimately associated with the growth of orna-

mental plants and flowers, and comprise conservatory, plant stove, greenhouse, and the subsidiary pits and frames. They should be so erected as to present the smallest extent of opaque surface consistent with stability. With this object in view, the early improvers of hot-house architecture substituted metal for wood in the construction of the roofs, and for the most part dispensed with back walls; but the conducting power of the metal caused a great irregularity of temperature, which it was found difficult to control; and, notwithstanding the elegance of metallic houses, this circumstance, together with their greater cost, and some doubt as to their durability, has induced most recent authorities to give the preference to wood. The combination of the two, however, as in the Crystal Palace at Sydenham, shows clearly that, without much variation of heat or loss of light, any extent of space may be covered, and houses of any altitude constructed.

The earliest notice we have of such structures is given in the Latin writers of the 1st century (Mart., *Epigr.*, viii. 14 and 68); the Ἀδώνιδος κήποι, to which allusion is made by various Greek authors, have no claim to be mentioned in this connexion. Columella (xi. 3, 51, 52) and Pliny (*H.N.*, xix. 23) both refer to their use in Italy for the cultivation of the rarer and more delicate sorts of plants and trees. Seneca has given us a description of the application of hot water for securing the necessary temperature. The botanist Jungermann had plant houses at Altdorf in Switzerland; those of Loader, a London merchant, and the conservatory in the Apothecaries' Botanic Garden at Chelsea, were the first structures of the kind erected in British gardens. These were, however, ill adapted for the growth of plants, as they consisted of little else than a

huge chamber of masonry, having large windows in front, with the roof invariably opaque. The next step was taken when it became fashionable to have conservatories attached to mansions, instead of having them in the pleasure grounds. This arrangement, however, brought them within the province of architects, and for nearly a century utility and fitness for the cultivation of plants were sacrificed, as still is often the case, to the unity of architectural expression between the conservatory and the mansion.

Plant houses must be as far as possible impervious to wet and cold air from the exterior, provision at the same time being made for ventilation, while the escape of warm air from the interior must also be under control. The most important part of the enclosing material is necessarily glass. But as the rays of light, even in passing through transparent glass, lose much of their energy, which is further weakened in proportion to the distance it has to travel, the nearer the plant can be placed to the glass the more perfectly will its functions be performed; hence the importance of constructing the roofs at such an angle as will admit the most light, especially sunlight, at the time it is most required. Plants in glass houses require for their fullest development more solar light probably than even our best hot-houses transmit,—certainly much more than is transmitted through the roofs of houses as generally constructed.¹

¹ Mr Knight, an unquestionable authority, proposed a general pitch or elevation of 34° for the latitude of London, the angle at which the rays of the mid-day sun are perpendicular to the surface on the 20th of May and 21st of July. This would afford four months, from the 20th of April to the 21st of August, during which the angle of incidence at mid-day would not at any time amount to 9° , while the deviation at the winter solstice would be 43° , and the loss of light from reflexion would be little more than $\frac{1}{6}$. The angle of 45° has been recommended as a pitch extremely suitable for early vineries and pine stoves,

Plant houses should be constructed of the best Baltic pine timber, as being the most durable, but the whole of the parts should be kept as light as possible. In many houses, especially those where ornament is of no consequence, the rafters are now omitted, or only used at wide intervals, somewhat stouter sash-bars being adopted, and

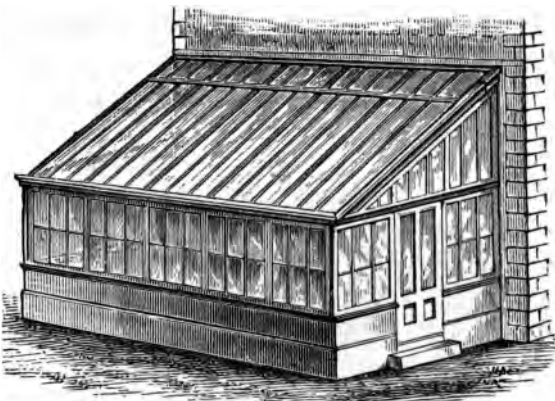


FIG. 4.—Lean-to Plant House.

stout panes of glass, 8 to 12 inches wide, made use of. Such houses are very light; being also very close, they require prompt and careful ventilation. The glass roof is commonly designed so as to form a uniform plane or slope from back to front in lean-to houses (fig. 4), and from centre to sides

in which case the midsummer deviation would be 19° , and the loss $\frac{1}{10}$, and the winter deviation 30° , the loss being nearly the same. Greater exactness, however, has been sought in this matter than is at all necessary. The reduction of the opacity of the roof arising from the breadth and depth of rafters and astragals is of much more consequence. The massive rafters, framed sashes, and inferior glass inserted in small fragments, with numerous overlaps liable to be choked with dirt, intercept a large proportion of the solar light and heat in ordinary glass houses.

in span-roofed houses. In some cases, however, the roof sashes are fitted up on the ridge-and-furrow principle invented by Sir Joseph Paxton, shown in fig. 5, which represents the original ridge-and-furrow house erected by him at Chatsworth. To secure the greatest possible influx of light, some scientific horticulturists recommend curvilinear roofs; but the superiority of these is largely due to the absence of rafters, which may also be dispensed

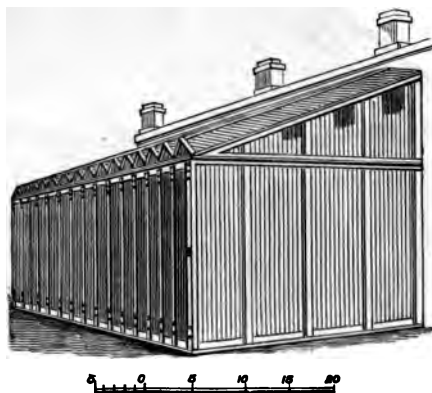


FIG. 5.—Ridge-and-Furrow Plant House.

with in plain roofs. Span and ridge-and-furrow roofs, the forms now mostly preferred, are exceedingly well adapted for the admission of light, especially when they are glazed to within a few inches of the ground. They can be made, too, to cover in any extent of area without sustaining walls. Indeed, it has been proposed to support such roofs to a great extent upon suspension principles, the internal columns of support being utilized for conducting the rain-water off the roof to underground drains or reservoirs. The lean-to is the least desirable form, since it scarcely

admits of elegance of design, but it is necessarily adopted in some cases.

In glazing, the greater the surface of glass, and the less space occupied by rafters and astragals as well as overlaps, the greater the admission of light. Some prefer that the sash-bars should be grooved instead of rebated, and this plan exposes less putty to the action of the weather. The bedding of the glass and use of copper tacks, without over putty, is widely approved ; but the glass may be fixed in a variety of other ways, some of which are patented. In Beard's method (a very good one) the glass is fixed between strips of felt, the covering bar being held in position by white metal nuts tightly screwed. Good results have been obtained from the systems introduced and improved by Rendle and Helliwell, which cover all the framework of the roof with glass, so that the timber is not exposed to the vicissitudes of weather.

The *Conservatory* is often built in connexion with the mansion, so as to be entered from the drawing-room or boudoir. But when so situated it is apt to suffer from the shade of the building, and is objectionable on account of admitting damp to the drawing-room. Where circumstances will admit, it is better to place it at some distance from the house, and to form a connexion by means of a glass corridor. In order that the conservatory may be kept gay with flowers, there should be subsidiary structures to receive the plants as they go out of bloom. The conservatory may also with great propriety be placed in the flower garden, where it may occupy an elevated terrace, and form the termination of one of the more important walks.

Great variety of design is admissible in the conservatory, but it ought always to be adapted to the style of the mansion of which it is a prominent appendage. Some very pleasing examples are to be met with which have the form of a parallelogram with a lightly rounded roof ; others of appropriate character are square or nearly so, with a ridge-and-furrow roof. Whatever the form, there must be light in abundance ; and the shade both of buildings and of trees

must be avoided. A southern aspect, or one varying to south-east or south-west, is preferable; if these aspects cannot be secured, the plants selected must be adapted to the position. The central part of the house may be devoted to permanent plants; the side tables and open spaces in the permanent beds should be reserved for the temporary plants.

The kind of plants adapted for planting out in conservatories are palms, cycads, dracænas, aralias, luculias, camellias, &c., with fuchsias, habrothamnus, plumbago, strong-growing scarlet pelargoniums, &c., on the pillars, and tacsonias, passifloras, lapagerias, &c., on the roof.

The *Greenhouse* is a structure designed for the growth of such exotic plants as require to be kept during winter in a temperature considerably above the freezing point. The best form is the span-roofed, a single span being better even than a series of spans such as form a ridge-and-furrow roof. For plant culture, houses at a comparatively low pitch are better than higher ones where the plants have to stand at a greater distance from the glass, and therefore in greater gloom. Fig. 6 represents a form of house adopted by a most successful cultivator, Mr B. S. Williams, of Holloway. It is 20 feet wide and 12 feet high, the length in this case being 50 feet, but of course any other convenient length could be adopted. The side walls are surmounted by short upright sashes which open outwards by machinery *a*, and the roof is provided with sliding upper sashes for top ventilation. In the centre is a two-tier stage for plants, 6 feet wide, with a pathway on each side 3 feet wide, and a side table

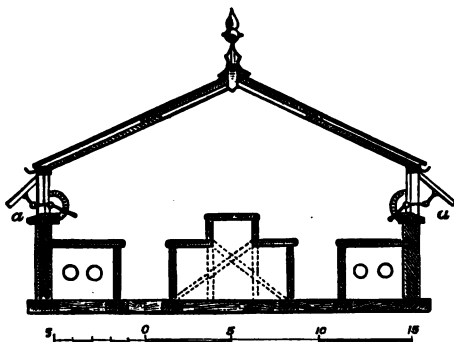


FIG. 6.—Section of Greenhouse.

4 feet wide, the side tables being flat, and the centre stage having the middle portion one-third of the width elevated 1 foot above the rest, so as to lift up the middle row of plants nearer the

light. Span-roofed houses of this character should run north and south so as to secure an equalization of light, and should be warmed by two 4-inch hot-water pipes carried under the side tables along each side and across each end. Where it is desired to cultivate a large number of plants, it is much better to increase the number of such houses than to provide larger structures. The smaller houses are far better for cultural purposes, while the plants can be classified, and the little details of management more conveniently attended to. Pelargoniums, cinerarias, calceolarias, cyclamens, camellias, heaths, Australian plants, roses, and other specialties might thus have to themselves either a whole house or part of a house, the conditions of which could then be more accurately fitted to the wants of the inmates.

The lean-to house is in most respects inferior to the span-roofed, but is more easily kept warm. One of the latter could be converted into two of the former of opposite aspects by a central wall; but except where space does not permit a span-roof to be introduced, a lean-to is not to be recommended. A house of this class may often be greatly improved by adopting a three-quarter span or hipped roof (as in fig. 9), that is, one with a short slope of glass behind and a longer one in front.

Where the cultivation of large specimens of heaths, Australian plants, Indian azaleas, &c., has to be carried on, a span-roofed house of greater height and larger dimensions may sometimes prove useful; but space for this class of plants may generally be secured in a house of the smaller elevation, simply by lowering or removing altogether the staging erected for smaller plants, and allowing the larger ones to stand on or nearer the floor.

The *Plant Stove* differs in no respect from the greenhouse except in having a greater extent of hot-water pipes for the purpose of securing a greater degree of heat, although, as the plants in stove houses often attain a larger size, and many of them require a tan bed to supply them with bottom heat, a somewhat greater elevation may perhaps be occasionally required in some of the houses. For the smaller plants, and for all choicer subjects, the smaller size of house already recommended for greenhouses, namely, 20 feet wide and 12 feet high, with a side table of 4 feet on each side, a pathway of 3 feet, and a central stage on two levels of 6 feet wide, will be preferable, because more easily managed as to the supply of heat and moisture. Mr Williams's plant stove (fig. 7), which is a very good model, is of the foregoing dimensions. It has,

however, a different arrangement from the greenhouse as to ventilation. It will be seen that along the ridge of the roof a raised portion or lantern light *b, b* is introduced, which permits of the fixing of two continuous ventilators, one along each side, for the egress of heated and foul air, openings *a, a* being also provided in the side walls opposite the hot-water pipes for the admission of pure cold air. Three or four rows of pipes will be required on each side, according to the heat proposed to be maintained.

In their interior fittings plant stoves require more care than greenhouses, which are much drier, and in which consequently the staging does not so soon decay. In stoves the tables should always be of slate or stone, and the supports of iron; slate is now most commonly used. This should be covered with a layer of 2 or 3 inches of some coarse gritty material, such as pounded spar, or the shell sand obtained on the sea-coast, on which the pots are to stand; its use is to absorb moisture

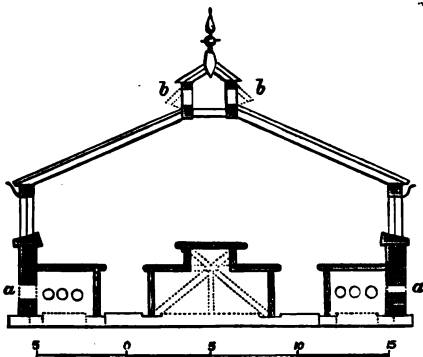


FIG. 7.—Section of Plant Stove.

and gradually give it out for the benefit of the plants. The pathways should be paved, or made of concrete and cement, and the surface should be gently rounded so that the water required for evaporation may drain to the sides while the centre is sufficiently dry to walk upon; they should also have brick or stone edgings to prevent the water so applied soaking away at the sides and thus being wasted.

The greenhouses, if large and ornamental, should be contiguous to the flower garden or pleasure ground; but if of the simple character employed only for growing decorative plants, it is better to associate them with similar houses set apart for other purposes, in an enclosed portion of the grounds contiguous to the potting sheds, where fuel and other materials required can be conveniently stored, and where all the untidiness of the workshops may be masked.

For this reason it is a very convenient plan to place side by side a series of small span-roofed houses for growing plants where they can be connected by a glazed passage-way at the back. The glazed way may be utilized for the cultivation of plants requiring less light than others, such as ferns, camellias, &c. ; it should communicate with the workmen's offices, which are commonly placed on the north side of the garden wall, so that potting and other cultural operations may be carried on without creating a block or confusion in the several houses. Wherever placed it is imperative that all plant houses, excepting ferneries, should have a free and abundant admission of light.

Fruit Houses.—The principal of these are the vinery, pinery, peach house, cucumber and melon house, and orchard house. These or a portion of them, especially the vineries and peacheries, are frequently brought together into a range along the principal interior or south wall of the garden, where they are well exposed to sun and light, an ornamental plant house being sometimes introduced into the centre of the range in order to give effect to the outline of the buildings. When thus associated, the houses are usually of the lean-to class, which have the advantage of being more easily warmed and kept warm than buildings having glass on both sides, a matter of great importance for forcing purposes.

The *Vinery* is a house devoted to the culture of the grape-vine, which is by far the most important exotic fruit cultivated in English gardens. When forming part of a range, a vinery would in most cases be a lean-to structure, with a sharp pitch (45° – 50°) if intended for early forcing, and a flatter roof (40°) with longer rafters if designed for the main or late crops. Mr A. F. Barron, a recognized authority on grape growing, recommends in the *Florist and Pomologist* (1879, p. 37) three classes of vineries, namely, *early* for the production of early or forced grapes, *general-crop* for all mid-season grapes, and *late* for producing and keeping grapes till late in the season, each requiring its own special arrangements; and the following are the three forms of houses recommended :—(1)

The *lean-to* (fig. 8) : this is the simplest form, often erected against some existing wall, and the best for early forcing, being warmer on

account of the shelter afforded by the back wall. In this house the principal part of the roof is a fixture, ventilation being provided for by small

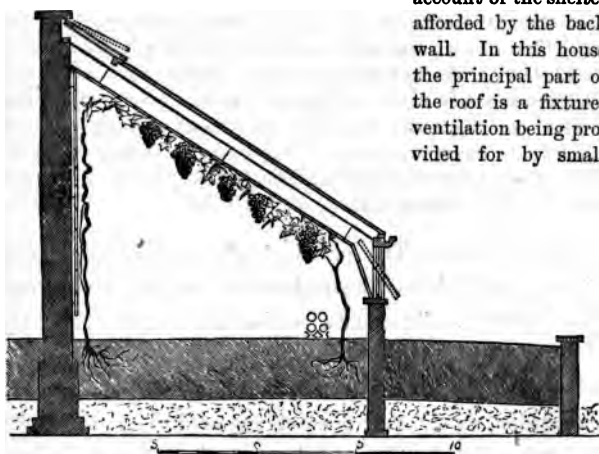


FIG. 8.—Lean-to Vinery.

lifting sashes against the back wall, and by the upright front sashes being hung on a pivot so as to swing outwards on the lower side. The necessary heat is provided by four 4-inch hot-water pipes, which would perhaps be best placed if all laid side by side, while the vines are planted in front, and trained upwards under the roof. A second set of vines may be planted against the back wall, and will thrive there until the shade from the roof becomes too dense.

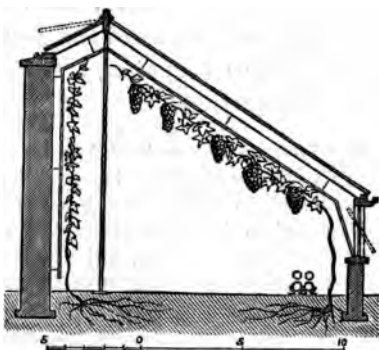


FIG. 9.—Hipped-Roofed Vinery.

(2) The *hipped-roofed* or three-quarter span (fig. 9) : this is a combination of the lean-to and the spanroofed, uniting to a great degree the advantages of both, being warmer than the span and lighter

than the lean-to. The heating and ventilating arrangements are much the same as in the lean-to, only the top sashes which open are on the back slope, and therefore do not interfere so much with the vines on the front slope. In both this and the lean-to the aspect should be as nearly due south as possible. Houses of this form are excellent for general purposes, and they are well adapted both for muscats, which require a high temperature, and for late-keeping grapes. (3) The *span-roofed* (fig. 10): this, the most elegant and ornamental form, is especially adapted for isolated positions;

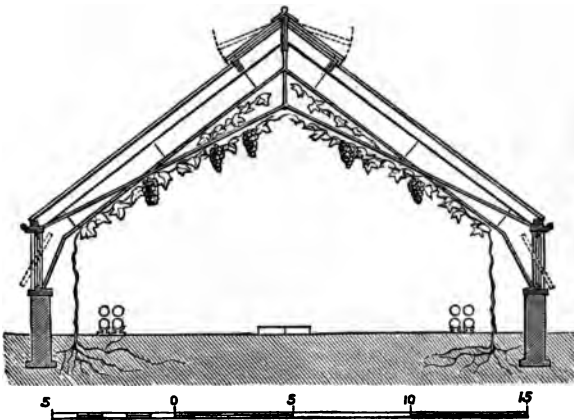


FIG. 10.—Span-Roofed Vinery.

indeed, no other form affords so much roof space for the development of the vines. The amount of light admitted being very great, these houses answer well for general purposes and for the main crop. The large amount of glass or cooling surface, however, makes it more difficult to keep up a high and regular temperature in them, and from this cause they are not so well adapted for very early or very late crops. They are best, nevertheless, when grapes and ornamental plants are grown in the same house. A sharper pitch of roof, with lower side walls and no upright sashes, but with ventilators near the ground, is sometimes preferred.

The *Pinery* is a house devoted to the cultivation of the pineapple. The pineries or pine stoves of former times were generally large lofty structures of the lean-to vinery fashion, and heated by smoke flues; but these were superseded by buildings of more

compact form, such as that of Baldwin, a noted pine grower of his day, in which the low roof was hipped, the short or northern slope being of slate, and the glazed sashes being fixtures. These were again improved by the substitution of glass for slate in the back slope, and of hot-water pipes for smoke flues as the heating medium, openings being provided at back and front, as at *a, a* (fig. 11), for ventilation. Such houses as

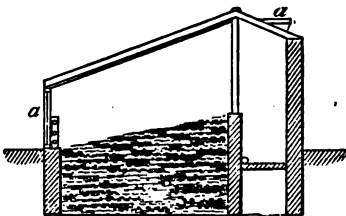


FIG. 11.—Section of Pinery.

these are low, and therefore are more economically kept at the high temperature necessary for pine growing. The best form of pinery is a low structure of this kind, but somewhat wider, so

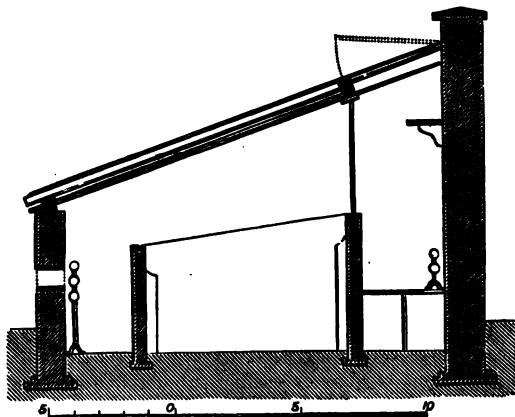


FIG. 12.—Modern Pinery.

as to permit of the utilization of the front and back spaces for general forcing purposes (fig. 12). Such a house might be 14 feet wide, consisting of a plunging bed for bottom heat 8 feet wide, a back path of 2 feet provided with a shelf for strawberries near the glass, a front path of 2 feet, and between that and the front wall a stage for pots, which might be used for forcing French beans, and which should be on the same level as the front curb of the centre

pit, and about $2\frac{1}{2}$ feet from the glass. The height of the back wall should be 15 feet. The house should be heated by three or four hot-water pipes placed beneath the front stage, and two placed close to the wall in the back path ; and the necessary bottom heat should be provided by fermenting tan or leaves, or by hot-water pipes or a hot-water tank placed beneath the plunging bed. Ventilators should be fixed at short intervals in the front wall beneath the stage and opposite the heating pipes ; and the alternate upper sashes should be made to open, or corresponding ventilators close to the top of the back wall should be provided.

If the stock of pine plants is not extensive, certain and abundant crops of fruit cannot be expected ; and it is therefore necessary to have not only fruiting pineries but pineries for succession plants. These are generally called *pine pits*, and differ little from the pits used for accommodating other tender plants. Two or three succession pits are required to provide a stock of plants to keep the fruiting-house filled. Low-roofed pits are to be preferred, not only on account of their appearance, but because the pine can only be cultivated in its highest state of perfection when grown in pits just sufficient for the full development of the foliage and crown of the fruit. These pits, if span-roofed, should be provided with a central path under the ridge, just high enough for a workman to stand upright, and a plunging-pit on each side ; but any ordinary well-constructed pit will answer the purpose if sufficiently heated.

The *Peach House* is a structure in which the ripening of the fruit is accelerated by the judicious employment of artificial heat. For early forcing, as in vineries, the lean-to form is to be preferred, and the house may have a tolerably sharp pitch. A width of 7 or 8 feet, with the glass slope continued down to within a foot or two of the ground, and without any upright front sashes, will be suitable for such a house, which may also be conveniently divided into compartments of from 30 to 50 feet in length according to the extent of the building, small houses being preferable to larger ones. As a very high temperature is not required, two or three pipes running the whole length of the house will suffice. The front wall should be built on piers and arches to allow the roots to pass outwards into a prepared border, the trees being planted just within the house. Abundant means of ventilation should be provided.

For more general purposes the house represented in fig. 13 will be found more useful. One set of trees is planted near the front and trained to an arched trellis *b*. Another set is planted at the

back, and trained on a trellis *c*, which is nearly upright, and leans against the back wall; or the back wall itself may be used for training. There are no upright front sashes, but to facilitate ventilation there are ventilators *d* in the front wall, and the upper roof sashes are made to move up and down for the same object. Two or three hot-water pipes are placed near the front wall. The back wall is usually planted with dwarf and standard trees alternately, the latter being temporary, and intended to furnish the upper part of the trellis, while the permanent dwarfs are gradually filling up the trellis from below. In any case the front trellis should stop conveniently short of the top of the sashes if there

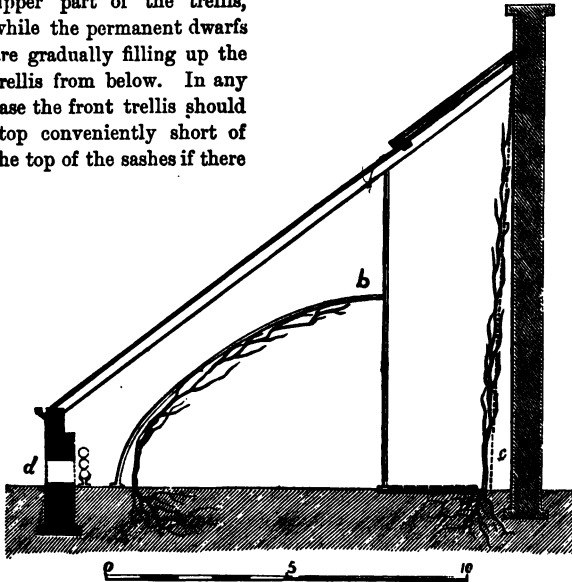


FIG. 13.—Peach House.

are trees against the back wall, in order to admit light to them. They would also be better carried up nearly parallel to the roof, and at about 1 foot distant from it, supposing there were no trees at the back.

A span-roofed house, being lighter than a lean-to, would be so much the better for peach culture, especially for the crop grown just in anticipation of those from the open walls, since a high temperature is not required. A low span, with dwarf side walls, and a lantern ventilator along the ridge, the height in the centre being

9 feet, would be very well adapted for the purpose. The trees should be planted inside and trained up towards the ridge on a trellis about a foot from the glass, the walls being arched to permit the egress of the roots. A trellis path should run along the centre, and movable pieces of trellis should be provided to prevent trampling on the soil while dressing and tying in the young wood.

The Cucumber and Melon House.—Wherever a continuous supply of cucumbers and a considerable number of melons are required, it is found most convenient to grow them in houses, the attention

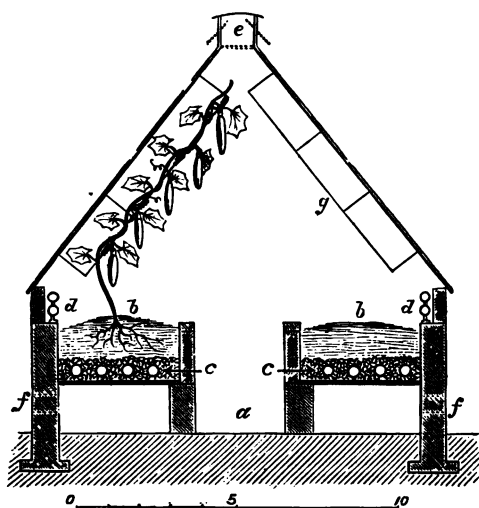


FIG. 14.—Span-Roofed Cucumber House.

required and the risk of failures being much less than when hot-beds and pits heated by fermenting materials are employed. The best form of house is a narrow span (fig. 14), on account of the much greater amount of light which it admits. The width should be 12 feet, the height about 10 feet, and the length divided into short portions so as to be worked in succession; a 60-foot house divided into three 20-foot portions would be found very useful, as one or more could be taken for either crop according to the demand. The inside arrangements should include a pathway *a* of 3 feet in the centre, two beds *b b* provided with hot-water pipes *c c* or hot-water tank for bottom heat two pipes *d d* on each side for warming

the atmosphere, a lantern ventilator *e* at the ridge, and openings in the wall *f* beneath the beds to admit fresh air, and a trellis *g* for training the plants, fixed at 12 or 18 inches from the roof.

Where the house is built against a wall, the hipped form of roof is to be preferred to the lean-to, as it admits more light, and allows more space for the cucumber or melon vines. Fig. 15, from Moore's *Treatise on the Cucumber*, shows such a structure, in which *b* is the pathway, *c* front ventilator, *d* back ventilator, *e* hot-water pipes, and *f* tank for bottom heat. The cold air admitted at *c* enters a chamber *g*; thence it passes into the space *h* over the water in the tank, and is admitted through a tube *m*, which passes up through the bed of soil, into the house near the front; similar tubes *n*, inserted at intervals along the front of the bed, are intended for supplying water amongst the rubble, to keep the soil at the roots constantly moistened.

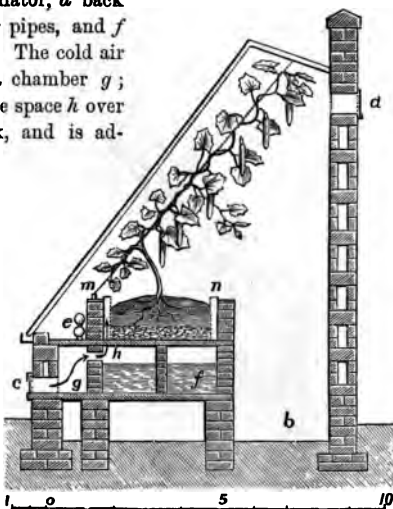


FIG. 15.—Moore's Cucumber House.

Pits and frames of various kinds are also frequently used for the cultivation of cucumbers and melons, as well as hot beds covered by ordinary garden frames. In these cases the first supply of heat is derived from the hot bed made up within the pit (fig. 17, *a*), which is all the better for having a layer or two of faggot-wood worked into it to facilitate the distribution of the heat from the linings later on. When the heat of the original bed subsides, linings of fermenting dung *b b* must be added, and these must be kept active by occasional turnings and the addition of fresh material as often as required. Figs 16 and 17 show different forms of pits of this character. It is, however, a vast improvement upon the old system to effect both top and bottom heating by hot-water pipes (fig. 16 *a a*), in which case the width of the pits may

be increased by at least 2 feet. Where there is much forcing carried on, the judicious arrangement of the several structures, permitting of their being worked from one boiler, should be carefully seen to.

Orchard Houses are the invention of the late Mr Rivers of Sawbridgeworth. In all the more genial portions of England and Scotland they may be used without fire-heat, and chiefly for potted fruit trees; and if the trees are well managed, a very large quantity and variety of fruit can be produced, of excellent if not first-rate quality. These houses will be found useful adjuncts to other structures even in large gardens, while they are of the utmost value to amateurs, who would otherwise be dependent on outdoor crops. They are, moreover, exceedingly economical, and may be turned to a variety of uses, being just as suitable for the growth of half-hardy flowers as for our less hardy fruits. For fruit trees the orchard

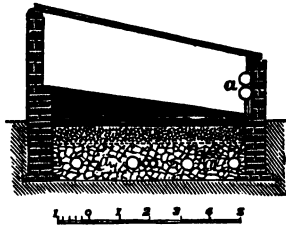


FIG. 16.—Cucumber Pit heated by Hot Water.

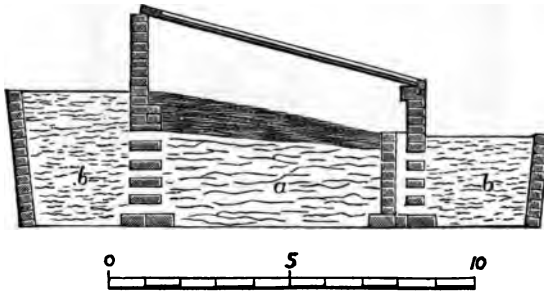


FIG. 17.—Cucumber Pit heated by Fermenting Dung.

houses are of most value in spring, not to excite but to protect the blossom buds, and in autumn to assist in ripening both fruit and wood. While peaches, nectarines, and apricots are the permanent occupants of the house, except in late autumn, when they may be set out of doors, plums, pears, and apples may all by this means be assisted to produce good crops. During winter and spring (when they should be kept cool) the trees may be stored as closely as possible and in this state they may remain until after blooming is

over and the fruits are set, when the hardier kinds should be gradually drawn out and hardened in sheltered spots, and eventually plunged in the open garden to swell their fruits, this thinning out affording room for the tenderer kinds.

The orchard house may be of the lean-to form or a span ; but the latter is much to be preferred. Fig. 18 is a sketch of Mr Rivers' small span-roofed orchard house, which is built of wood and glass. Two rows, 14 feet apart, of oak posts *a*, 5 by 3 inches and 9 feet long, or of deal posts set in cast-iron sockets, and firmly fixed 3 feet in the ground are set 5 feet apart. To each of these should be firmly nailed the plate *b*, 4 inches by 3, to receive the ends of the rafters *c*, which should be 8 feet long and 3 inches by 1½. The

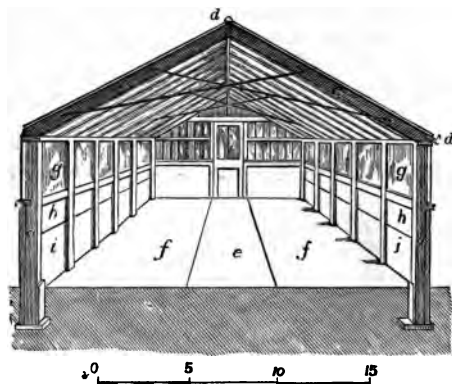


FIG. 18.—Rivers's Span-Roofed Orchard House.

ridge board *d* should be 3 inches by 1, to which the upper ends of the rafters, after being sloped, should be nailed. At the lower end a drip board, 5 inches by 1, placed sloping to receive the lower ends of the glass, must be fixed on the plate the full length of the house ; and on the ridge board a small ledge must be nailed for the upper ends of the glass panes to rest upon. On the upper edge of the ridge board a cap, 3 inches by 1, shaped thus Λ , should be nailed, to shoot off the water and prevent its entrance at the ridge. The sides *i* are boarded, and the roof is of 21 oz. glass, the rafters (stout sash-bars) being 20 inches part, and the panes 15 inches long, set end to end in glazing. Under the glass *g* on each side is a ventilating shutter *h*, ¾ inch broad and 1 foot wide, hinged and

opening downwards. The roof is stayed by irons screwed to every fourth rafter. The angular space over the door forms a ventilator. A house of this form should have a central path *e*, the two beds or spaces on each side *f* *f* accommodating the fruit trees either planted out or grown in pots. These beds may be raised above the path, as in fig. 19, if used for dwarf trees.

As a larger house, one of 24 feet width (fig. 19) might be recommended. The oak posts or deal posts in sockets, 6 inches by 4 must be set in two rows *a* *a*, 24 feet asunder, 6 feet apart in the rows, and the plates, rafters, ridge board, and drip board should be as described above. The apex of the ridge *d* should be 12 feet from the surface. The roof itself *c* is supported and steadied by two

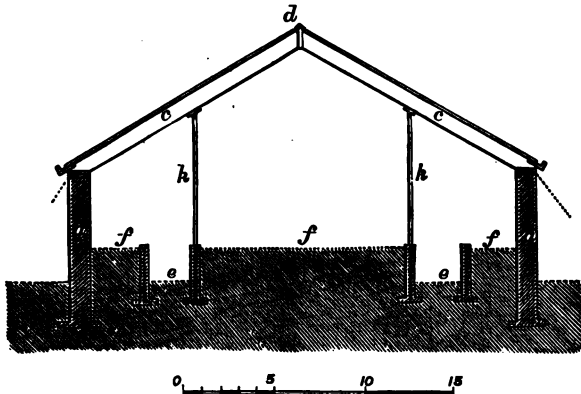


FIG. 19.—Orchard House with Raised Beds.

rows of iron pillars *k* connected by tie rods, and glazed with 21 oz. glass, the rafters being 20 inches apart. The sides and ends are boarded, and provided with hinged ventilators as in the smaller house. The floor may be level with the ground, and with a central path or two side paths *e* *e*. For dwarfier and more bushy plants, and for general purposes, the beds may be slightly raised, as *f*, *f*, *f* in fig. 19. When the trees are planted out the raised beds would be objectionable as diminishing the available height, but for potted plants they are an advantage, raising the trees nearer to the light.

In the north of England, and in all moist and cold districts of Scotland or Ireland, Mr Rivers recommends the introduction of a hot-water pipe or two into houses in which peaches, nectarines,

and apricots are to be grown, not to force them, but to ensure the ripening of both wood and fruit.

Pits and Frames.—These are used both for the summer growth and winter protection of various kinds of ornamental plants, for the growth of such fruits as cucumbers, melons, and strawberries, and for the forcing of vegetables. When heat is required, it is sometimes supplied by means of fermenting dung, or dung and leaves, or tanner's bark, but it is much more economically provided, on the score of labour at least, by hot-water pipes. Pits of many different forms have been designed, but it may be sufficient here to describe one or two which can be recommended for general purposes.

Fig. 20 represents a simple and useful form of pit designed for the Chiswick garden by Mr Sibthorpe, and published by Mr R.

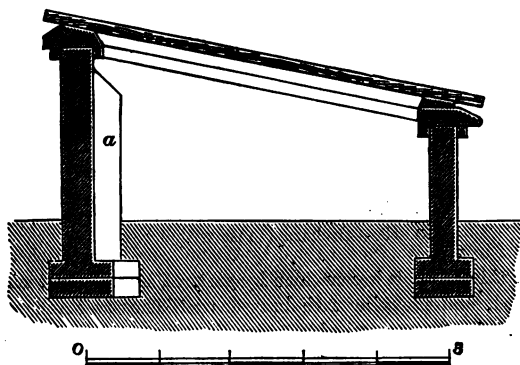


FIG. 20.—Sibthorpe's Plant Pit.

Thompson (*Gardener's Assistant*, 499). It is 7 feet wide, the front wall 2 feet high, the back wall $3\frac{1}{2}$ feet. The walls are one brick thick, or $4\frac{1}{2}$ inches, with a 4-inch pier *a* at every third rafter, the foundations being respectively 9 and 14 inches. The wall plates both at front and back project so as to allow the drip to fall clear

of the walls ; and fillets of wood fixed to their under surfaces and close up to the wall on each side serve to maintain both the wall plate and top of the wall steadily in their positions. Such a pit used for cucumbers or melons might be excavated slightly below the ground level to admit of bottom heat being supplied by a bed of fermenting dung, over which the soil should be placed in the usual way, bringing the plants up near to the glass ; or the bottom heat might be supplied by the tank system of heating or by hot-water pipes. For small stove plants of any kind the interior might be filled up with any porous materials, finishing off with a surface of fine coal ashes at a suitable height, or larger plants might be accommodated by using it as shown, without any filling up. Heat can easily be supplied by one or two 4-inch pipes, front and back, according to the temperature required ; but if fermenting material be used for this purpose, the lower portion of the walls, as far up as may be covered by the interior filling, should be pigeon-holed.

An excellent pit for wintering bedding-out plants or young greenhouse stock is shown at fig. 21. It is built upon the pigeon-hole principle as high as the ground level *a a*, and above that in 9-inch brickwork. At a distance of 9 inches retaining walls *b b* are built up to the ground level, and the spaces between the two are covered by thick boarding, which is to be

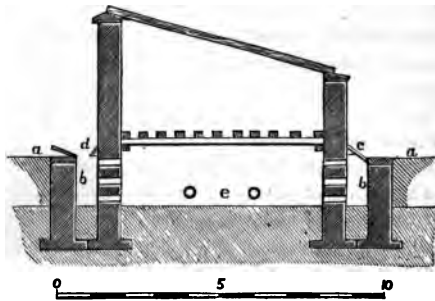


Fig. 21.—Ventilated Plant Pit.

shut down as shown at *c* in cold weather to exclude frost, and opened as shown at *d* in mild weather to promote a free circulation of air through the pit. The height of the pit might be reduced according to the size of the plants ; and, to secure the interior against frost, a flow and return hot-water pipe *e* should pass along beneath the staging, which should be a strong wooden trellis supported by projections in the brickwork. The water which drains from the plants or is spilt in watering would fall on the

bottom, which should be made porous to carry it away. For many plants this undercurrent of ventilation would be exceedingly beneficial, especially when cold winds prevent the sashes from being opened. A pit of this character may be sunk into the ground deeper than is indicated in the figure if the subsoil is dry and gravelly, but in the case of a damp subsoil it should rather be more elevated, as the outer soil could easily be sloped up to meet the retaining wall.

For all useful purposes these two forms of pits will suffice, but there will always be found occupation for some of the common hot-bed frames (fig. 22). They should be made of the best red deal, 1½

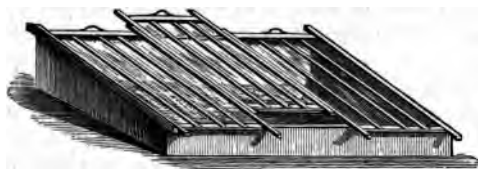


FIG. 22.—Hot-Bed Three-Light Frame.

inch thick. A convenient size is 6 feet wide, 24 inches high at the back, and 15 in front; and they are usually 12 feet long, which makes three lights and sashes, though they can be made with two lights or one light for particular purposes. Indeed, a one-light frame (fig. 23) is often found very convenient for many purposes. The lights should be 2 inches thick, and glazed with 21 oz. sheet glass, in broad panes four or five to the breadth of a light, and of a length which will work in conveniently and economi-



FIG. 23.—One-Light Frame.

cally, very long panes being undesirable from the havoc caused by accidents, and very short ones being objectionable as multiplying laps, and the chances of drip; panes of from 6 to 8 inches long are of convenient size for garden lights of this character. In all gardens the frames and lights should be of one size so as to be interchangeable, and a good supply of extra lights (sashes) may always be turned to good account for various purposes.

Boulton and Paul's span-roof garden frame (fig. 24) may under some circumstances be useful as a substitute for the three-light frame. It is adapted for storing plants in winter, for nursing small

plants in summer, and for the culture of melons and other crops requiring glass shelter. These frames are made 11 inches high in front, 22 at the back, and 32 at the ridge, with ends of $1\frac{1}{2}$ -inch red deal; the sashes, which are 2 inches thick, open by gearing, the front and back separately. The lights are hinged so that they can



FIG. 24.—Span-Roof Frame.

be turned completely back when necessary. This more direct and ready access to the plants within is one of the principal recommendations of this form of pit.

Mushroom House.—Mushrooms may be grown in sheds and cellars, or even in protected ridges in the open ground, but a special structure is usually devoted to them. A lean-to against the north side of the garden wall will be found suitable for the purpose, though a span-roofed form may also be adopted, especially if the building stands apart.

The internal arrangement of a lean-to mushroom house is shown in fig. 25. The length may vary from 30 feet to 60 feet; a convenient width is 10 feet, which admits of a $3\frac{1}{2}$ feet central path, and beds 3 feet wide on each side. The shelves should be of slate *a a*, supported by iron uprights *b b*, each shelf having a front ledge of bricks set on edge in cement *c c*. The slabs of slate forming the shelves should not be too closely fitted, as a small interval will prevent the accumulation of moisture at the bottom of the bed. They may be supported by iron standards or brick piers, back and front, bearing up a flat bar of iron on which the slates may rest; the use of the bar will give wider intervals between the supports, which will be found convenient for filling and emptying the beds. The roof may be tiled or

slated; but, to prevent the injurious influence of hot sun, there should be an inner roof or ceiling *d*, the space between which and the outer roof *e* should be packed with sawdust. A hot-water pipe *f* should run along both sides of the pathway, close to the front ledge of the lowest beds. The different shelves can be planted in succession; and the lower ones, especially those on the floor level, as being most convenient, can be utilized for forcing sea-kale and rhubarb.

Another style of house which answers remarkably well may be formed by an arch of brickwork, making a kind of tunnel, or by a semi-arch projected against a brick wall or against the side of a bank (fig. 26). In either case the arch *d* should be covered with a thick bank of earth *e*, and planted with spreading shrubs to keep it cool and shaded. The size of the beds and the fitting up may be exactly the same as in fig. 25 already described, except that on one side the available height will be necessarily less.

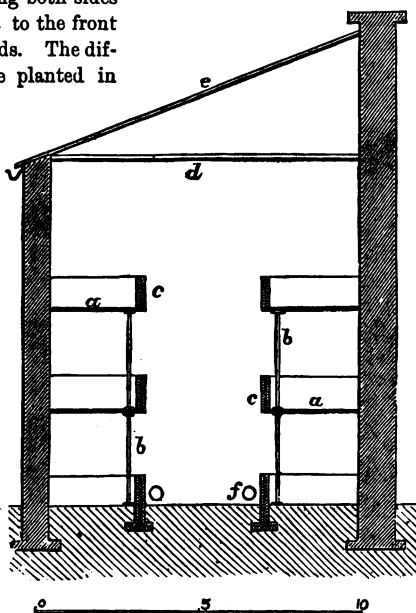


FIG. 25.—Lean-to Mushroom House

Fruit Room.—In many gardens a portion of the shed accommodation behind the ranges of glass-houses is made to do service as a fruit room, but it is sometimes difficult to secure in this way the conditions favourable for the conservation of fruit. The main requisites are coolness and a steady uniform temperature, combined with

darkness, and moderate but not excessive dryness. A dry cool cellar makes an excellent fruit room.

One of the most successful examples of a fruit room is that of Mr Moorman of Clapham, described by Mr Robert Thompson in the *Journal of the Horticultural Society* (vi. 110), of which figs. 27 and 28 represent a plan and section. The building in this case was not specially erected for a fruit room, having been originally a loft over

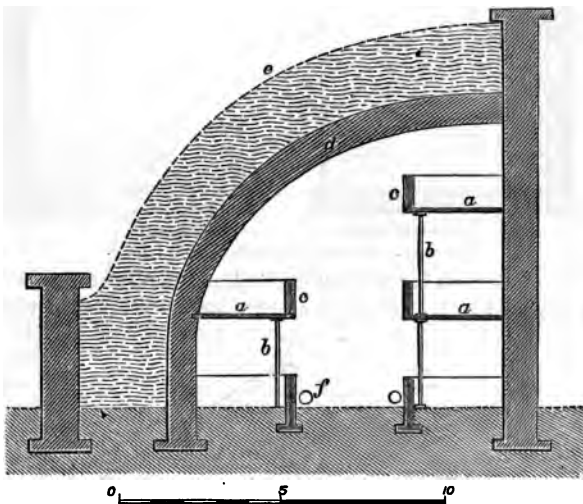


FIG. 26.—Semi-Arch Mushroom House.

a coach-house. The walls have an inner lining of board enclosing a cavity, which is probably one cause of the efficiency of the apartment, since the wood lining and the cavity containing air both act as slow conductors of heat. The ceiling on the north side is double, which also conduces to the same end. There is a swing window *b*, opened a little occasionally, but always covered with a roller blind so as to shut out light, and there is a small stove *c*, but seldom used, and never for the sake of warming the air, unless the temperature is below freezing; if damp is observed a little fire is lighted on a dry day, and this with ventilation soon dissipates it. The fruit shelves *d d* are made with battens $1\frac{1}{2}$ inch wide and $1\frac{1}{4}$ inch apart, with a layer of clean straw placed across them, and on this the fruit is laid

out singly. The shelves are enclosed by a partition of open work *e e*, which is made of battens similar to the shelves themselves.

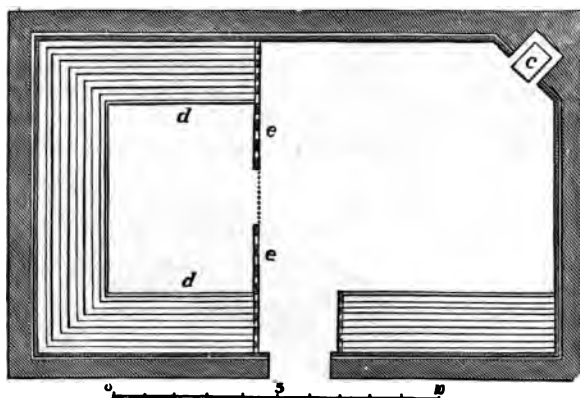


FIG. 27.—Moorman's Fruit Room (plan).

The fruit room in the Royal Horticultural Garden at Chiswick is a very good example of one on a larger scale. The floor of this is

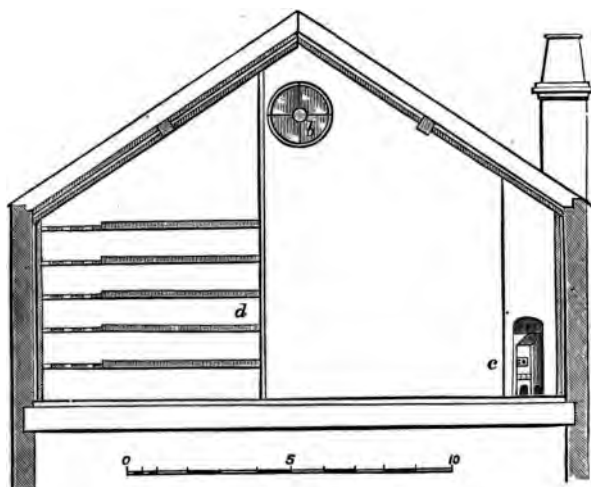


FIG. 28.—Moorman's Fruit Room (section).

sunk about 18 inches below the ground level, and is concreted to

keep out rats and mice. It is built against a north wall, and has a low sloping roof of slate. Three or four ranges of shelves are fixed all round against the walls, and there is a table occupying the centre for the display of samples of the different kinds grown. Such an apartment would form a convenient fruit room in a private garden establishment. The walls should be hollow ; and a ventilator made to open and shut, and communicating obliquely with the external air, should be inserted in the ceiling near each end, the interval between ceiling and roof being packed with dry sawdust to assist in keeping up a uniform temperature. The shelves should be made of narrow battens of wood laid somewhat apart, as in Mr Moorman's house, and the central table should be fitted with shallow drawers in which to store the very choicest fruits, such as the finer dessert pears, which should be individually wrapped in tissue paper and laid in a single tier. The better kinds of fruits on the open shelves should be laid out singly. It is a wise economy not to stint space in such a structure, as many things can be accommodated for a time in a room of this sort ; for example, the floor space beneath the shelves forms a good place for storing seed potatoes, especially those for the early crops. A window is necessary, as light will be occasionally required to examine and to select the fruits, but it should be tight-fitting, and on all other occasions closed by shutters so as to keep the interior dark. The door should also be closely fitted, to exclude the external air ; indeed it is better if the fruit room itself can be entered from an adjoining apartment, from which light need not be excluded, and which may serve as a seed room and store room for many of the smaller garden requisites. If a hot-water pipe can be run round these apartments from some neighbouring apparatus, so much the better, but in the fruit room proper it should only be used occasionally to dispel damp, or, in the case of very severe weather, to keep out frost.

Heating Apparatus.—Plant houses are heated in a variety of ways, but practically smoke flues and hot-water pipes are principally made use of. The cost of erection is a little more for hot-water pipes than for flues, but the former are the cheaper in the end. Steam is not now used as a heating medium, except where the waste steam of a manufactory is turned to account in some adjoining garden. The use of fermenting vegetable substances in

the production of heat is also rapidly disappearing from our best gardens before the application of hot water, which is far more economical and certain in its effects.

The *Smoke Flue*, that is, the continuous cavity commencing at the back of the furnace and ending at the chimney, when used as a source of heat, should be carried along the front of the house, returning near the back; by the time it has run thus far most of the heat taken up from the fuel will be in course of transmission to the enclosed atmosphere of the house to be heated. There should be a gradual rise for some distance after leaving the furnace, which should be from 1 to 2 feet below the level of the front flue; and there should be no sharp angles or turnings. Earthenware pipes may be substituted when appearance is not a consideration. Smoke flues should be cleaned out at least once a year. When properly constructed, they answer their purpose sufficiently well; but this mode of heating is now virtually superseded in all gardens of note by the hot-water system.

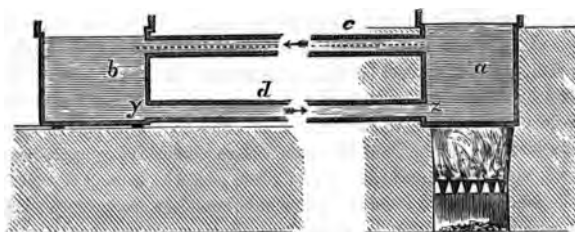


FIG. 29.—Diagram of Tank Boiler showing Circulation in Pipes

Hot Water.—The diffusion of heat in plant houses by causing hot water to circulate in iron pipes or vessels was brought into notice in 1827, and has gradually supplanted all other modes. The apparatus is more durable than flues, occupies less space, can be placed in situations where flues cannot, is more elegant in appearance, gives out a more steady and uniform heat, and can seldom be overheated. The cause of the circulation of the water in the pipes may be seen by reference to fig. 29. When the water in the boiler *a* is heated, it expands and thus becomes lighter than that in the cistern *b*; the pressure at *z* in the horizontal pipe *d* is thus less than at *y*, so that the water flows through *d* from *b* to *a*, and *b* is kept supplied from the pipe *c*. In this arrangement, which

represents the common tank boiler, with a cistern at the extremity of the pipes, the process of heating was slow, and many changes have consequently been made.

The Furnace.—The most perfect furnace is that in which the combustion is most complete. On this account the fire should be surrounded by slow conductors of heat, such as Welsh lumps or other kinds of fire-brick ; and the sides of the furnace should not be formed by any part of the boiler, nor should the furnace bars be tubular and connected with the boiler, though this latter plan is sometimes adopted to prevent the burning out of the bars. All the air necessary for maintaining combustion should enter from below,

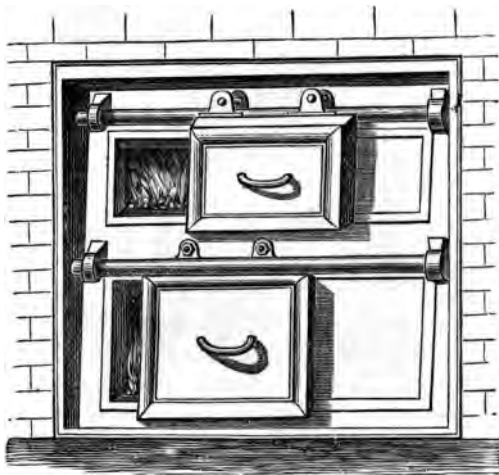


FIG. 30.—Sliding Furnace Doors.

that is, through the ash pit, and not through the door or sides of the furnace ; but to produce this effect the furnace should be fitted with double doors and ash-pit registers, for thus only can the stoker have control over his furnace. By shutting the ash-pit and furnace door closely combustion is lessened, and the fire may be kept almost in a state of quiescence for many hours together ; while, on opening either the door or ash-pit register, air is admitted and combustion goes on. Sylvester's furnace doors or doors of similar sliding form (fig. 30) are preferable to the ordinary hinged doors, because they can be opened to any extent, and are less liable to get out of order.

These doors are faced with fire-brick, and run on rollers on an iron rod, or slide by means of a ledge. Mr Taplin recommended, in the *Florist and Pomologist* (1868, p. 32), that, to prevent the burning away of the furnace bars and the formation of clinkers, the ash-pit should be kept filled with water, and states that the bars will then last three times as long as with the ordinary dry ash-pit. The ash pit may be built in cement for this purpose, or fitted with a cast-iron pan for the water.

Hot-Water Boilers.—Only a few of the principal types of the very diverse kinds of boilers can be noticed here. The simpler the form

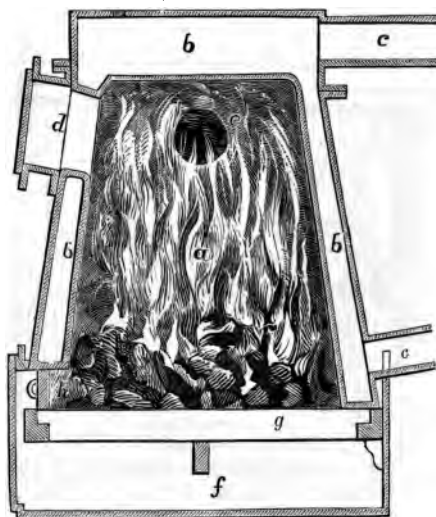


FIG. 31.—Rogers's Conical Boiler.

and the less complicated the whole apparatus is the better. It is essential that a large area of the boiler surface should be brought within the direct action of the fire.

Rogers's Conical Boiler (fig. 31), which has long been in use, is very suitable for heating pits and small houses, since it is economical of fuel, and gives out a steady heat for a long time—15 to 20 hours. It is formed of two truncated concentric cones, with a space of 2 or 3 inches between for the water, the furnace being in the inner cone, and the fuel supplied from near the top. It was originally

surrounded with brickwork, but several improvements have been introduced. In fig. 31 the boiler is placed in a cast-iron stand, with ground circular furnace, and register ash-pit doors,—*a* being the furnace, *b* the boiler, *c* flow and return pipes, *d* the furnace door, *e* smoke-pipe to the vent, *f* ash-pit, *g* grating, *h* hole for cleaning the furnace. The best kinds of fuel are coke, gas-cinders, and anthracite ; but common coal which does not cake very much is also suitable, as it is soon formed into coke.

Saddle Boilers.—The saddle boiler is a very efficient form, steady and sure in its working. In its improved forms it is, perhaps, the best for general purposes. It should be set over a furnace, the sides and end of which should be of fire-brick. It may be quite plain, or with the inner surface ribbed or corrugated (fig. 32), a

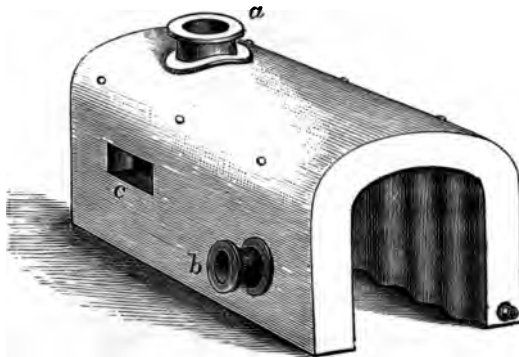


FIG. 32.—Gray's Saddle Boiler.

modification adopted by Mr Gray of Chelsea. In all saddle boilers, which should be deep from front to back, and set well back from the doors of the furnace, the full force of the fire strikes the dome of the boiler directly, and so long as the fire continues this is the part most directly influenced by its heat. The flow pipe is shown at *a*, and the return pipe at *b*, while *c* represents an opening (one on each side) for the passage of the smoke into the flues, the end being a water-way, and forming part of the boiler. The boiler is emptied by a small tap affixed to the pipe shown in the front.

There are many forms of what are called *Flued Saddle Boilers*, all of them good and thoroughly efficient if properly set. One of these, with a terminal water-way, is shown in elevation at fig. 33,

and in section, showing the mode of setting, at fig. 34. The fire is made under the principal arch *a*; the flame and smoke return

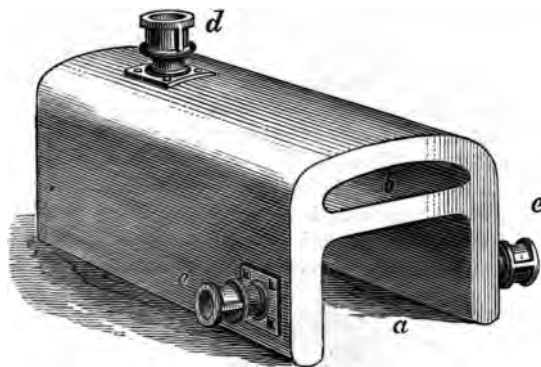


FIG. 33.—Flued Saddle Boiler.

through the flue *b*, and then turn back over the top of the boiler to the outlet *c*, which can be placed at whatever point is in each case

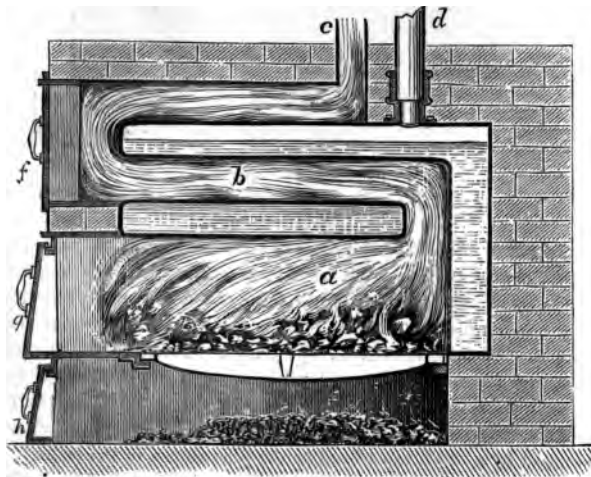


FIG. 34.—Flued Saddle Boiler (section).

most convenient. The other parts which need to be referred to

are—*d* flow pipe, *ee* return pipes, *f* soot-door for cleaning flues, *g* furnace door, *h* ash-pit door.

The *Gold Medal Boiler* (figs. 35–38) is perhaps one of the best of

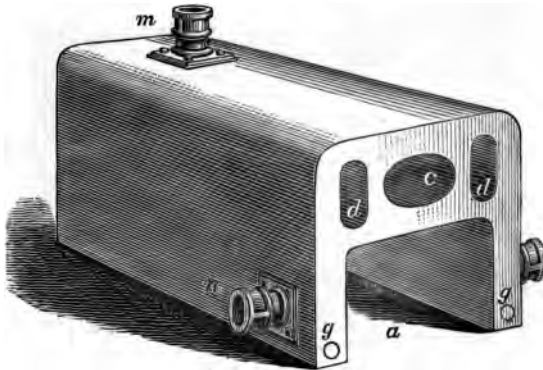


FIG. 35.—Gold Medal Boiler.

these modified saddles, and like the others has a dome or arch *a*, and back water-way *b*; the heated products of combustion striking

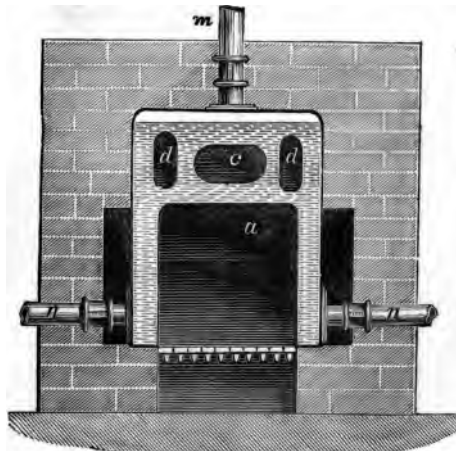


FIG. 36.—Gold Medal Boiler (transverse section).

against this back are sent up the central flue *c*, and then diverted

into the side flues *d d*, before passing into the chimney shaft *e*.



FIG. 37.—Gold Medal Boiler (longitudinal section).

Fig. 36 shows a transverse section, and fig. 37 a longitudinal section

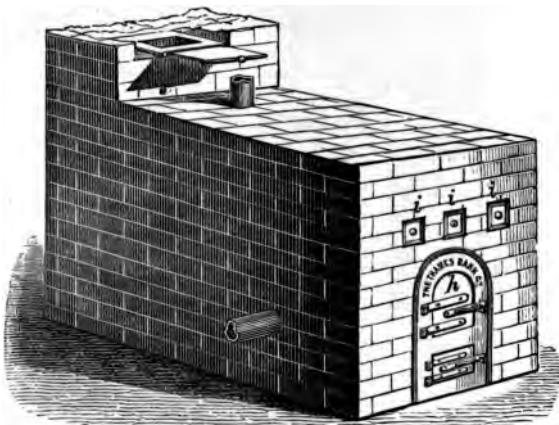


FIG. 38.—Gold Medal Boiler (brickwork setting).

set in brickwork, which is shown in elevation in fig. 38. The ash-

pit is shown at *f*, the furnace door at *h*, the centre and side flues at *c* and *d*, the water-way end at *b*, the soot-door at *i*, the sludge-plugs for cleaning out the interior at *g*, the flow pipe at *m*, the return at *n*, while *l* shows a hollow space around the boiler for utilizing the heat given off by its exterior surface. This boiler is named from its having won the gold medal in a boiler competition at Birmingham in 1872. The Witley Court boiler and the Glasgow boiler are both excellent forms of the flued saddle type.

Stevens's Trentham Boiler (fig. 39) is a very powerful and economical one, for large establishments especially. It is a modification of the well known Cornish boiler, and consists of two

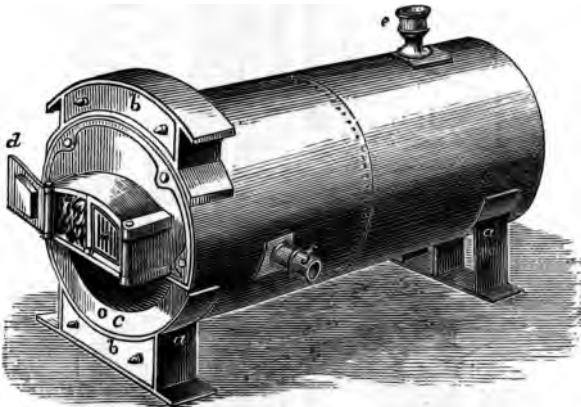


FIG. 39.—Stevens's Trentham Boiler.

wrought-iron cylinders substantially rivetted together, and having a water space of about 2 inches between them. The frame for the furnace doors *d* is attached to the front. It is supported by two cast-iron chairs *a a*, the front chair forming the frame for the lower flue doors *b*, which fasten by a simple catch and can readily be lifted off for cleaning the flues. The plug *c*, opened by unscrewing it, is for the purpose of clearing out all interior accumulations of dirt, which should be done thoroughly at short intervals. The flow pipe is at *e*, the return at *f*. In setting, the chairs are placed level on a solid foundation, and two 9-inch walls are built up so as just to clear the boiler, and about level with the centre of the cylinder; on these a course of fire-brick lumps is laid, and brought close up to the side of the cylinder, and resting on the lumps an arch is

turned leaving a space the depth of the top flue doors *b*, to serve as an upper flue, while the space below forms a lower flue. The grate bars are inside the cylinder towards the lower part, the space above them forming the furnace, and that below them the ash-pit. The

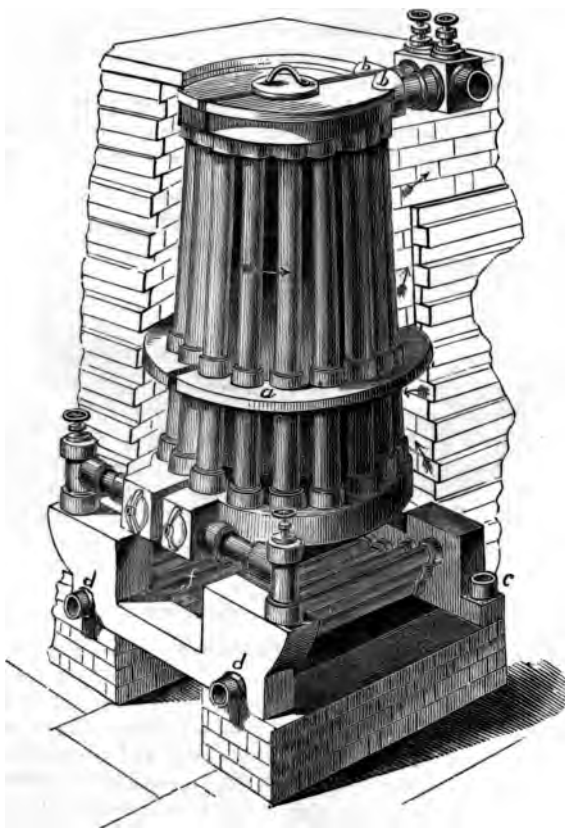


FIG. 40.—Weeks's Duplex Tubular Boiler.

heat thus passes through the centre of the cylinder, then returns by the upper flue over its top, and is conducted to the chimney by the lower flue, which arrangement is found to work better than when the heated air is made to pass through the lower flue first.

Tubular Boilers.—While the action of tubular boilers is rapid, and they are undoubtedly very powerful, they are said to be prodigal in their consumption of fuel, and liable to crack. In numerous cases, however, they have done good work for many years, and they are consequently employed to a considerable extent. The original tubular boilers were horizontal, but the upright form has nearly superseded this, and the *Upright Oval Tubular* of Mr Gray, and the *Duplex Upright Tubular* of Messrs Weeks & Co., both of Chelsea,—the latter marked by improvements introduced specially to meet the foregoing objections,—are the best forms at present in use. The Duplex (fig. 40) is made in two equal parts, each being

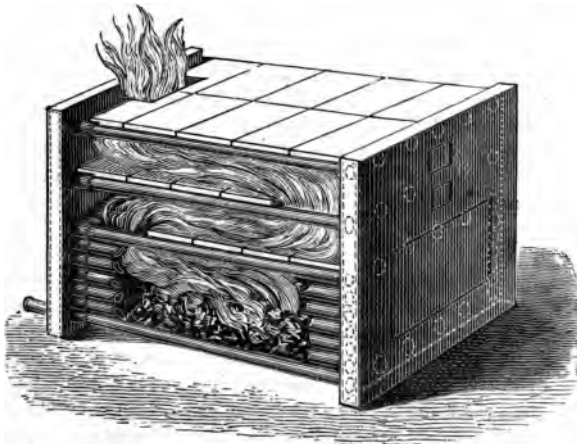


FIG. 41.—Ladd's Boiler.

capable of being worked alone. Each section consists of a semicircle of upright tubes forming the boiler proper, fitted with the diaphragm *a*, by which more perfect combustion of the fuel is secured, a series of horizontal pipes forming the furnace *f*, a flow pipe *b* and a return pipe *c*, and an outlet *d* for removing sedimentary deposits from the interior.

Ladd's Boiler (fig. 41) is a horizontal tubular, which is found to be extremely powerful as well as economical. It is a rectangular box 6 feet long, made of 2-inch iron pipes, fixed into hollow water spaces which form the ends; these pipes act as fire bars, and form the sides of the furnace. Above the fire there are three series of

horizontal pipes, each covered by a layer of tiles so placed as to convert the two intervening spaces into flues, along which the flames and smoke travel for 18 feet, the smoke escaping at the far end by an opening in the upper layer of tiles. Each tier of pipes in its turn therefore gets its share of heat from the burning fuel, and the consequence is that the apparatus is very quick in its action. The tubes are fitted in with Portland cement and hempen cord packing—tar ropes being found to destroy the cement. These boilers each heat 3000 feet or more of 4-inch piping. On the top of the upper layer of tiles are placed about 9 inches of ashes, then ordinary inch boards which rest on $4\frac{1}{2}$ -inch retaining walls, and on these 8 or 10 inches more of ashes, which very efficiently prevents any loss of heat.

Stoves, &c.—In the case of very small houses petroleum stoves or lamps are sufficient to keep out all ordinary frost, but they are attended with a disagreeable smell. A small conical or cylindrical boiler attached to a system of piping is by far the safest and best in such cases, and the furnace heating may then be effected either with petroleum, or, better still, as requiring less attendance, with gas. The furnace should be accessible from the outside only, so that none of the products of combustion may enter the house. A small conservatory might be readily heated in this way from a furnace fixed in a recess of the back wall, or in the basement of the house, and placed near one of the fire-places, so that the outlet may be conducted into the chimney. A flow and return passing along under the side and front stage (avoiding doorways) might be kept heated by means of a small boiler of any form set over a circlet of gas jets. If on the level, the arrangement would be more simple still, since the boiler could be set in the house without brickwork, and the furnace constructed beneath it by piercing through the exterior wall, and fitting the opening with an ordinary furnace door.

Hot-water pipes are best made of cast-iron. Tow or rope, and a mixture of red and white lead, are generally used for packing or caulking the joints, though some prefer vulcanized india-rubber rings, which make good sound joints, and are very easily removable; for the joints near the fire iron cement must, however, be used. Flat pipes, and fluted or semi-circular pipes have sometimes been used, but the cylindrical form is much to be preferred. The number of pipes must be regulated by the extent to be heated, and the degree of temperature required; it is often well to have three or even four flow pipes and only one return pipe.

Pipes of 4-inch bore are almost universally employed, but 3-inch

pipes may often be used in small houses. It is a mistake to stint the quantity of piping, since it is far more economical and better for the plants to have a larger surface heated moderately than a smaller surface heated to the highest possible degree. The pipes should, moreover, be placed near the front or lowest part of the house, and, to prevent loss of heat by conduction, should be supported, 6 inches clear of the ground, upon cast-iron chairs.

Mr Cannell of Swanley has adopted the plan of fixing two or three distinct lines of small piping close under the roof glass, so as to prevent the air near the glass from getting cold. This contrivance is particularly useful in repelling damp during winter; it may also be adopted for warming pits intended for the growth of half-hardy plants, as it effects a great saving in covering up, both as regards materials and labour, and also in avoiding the breakage of glass.

Hot water may be beneficially applied to garden walls, not, however, for the purpose of forcing the blossoms, but to assist in maturing late fruit and the young wood in unpropitious seasons. To this end the walls must be built hollow, and the pipes placed near the bottom of the cavity, and supported on cast-iron chairs placed on the top of the foundation course of material. This method was first exemplified by Mr Atkinson in the gardens of the duke of Bedford at Woburn Abbey in 1828.

The *Tank System* of heating garden structures was introduced some years since by Mr W. E. Rendle. It consists in circulating hot water in broad shallow tanks instead of closed pipes. It will be obvious that as the water is to flow along these open (or only loosely covered) conduits, they must themselves be level, and the boiler must be either at the same level or below it, the connexion between them being made in either case by hot-water pipes of suitable form and length. The tanks are formed of wood, brick, stone, or cast-iron. When of wood, they require to be made of good sound plank, not less than 2 inches thick, and properly jointed, and they are usually covered with slates. Stone or brick tanks require to be lined with a thick coating of Roman cement, while stone, slate, or tile pavement may be employed for covers. The cast-iron tanks have covers of the same material.

When one tank only is employed, as for example in supplying bottom heat to the front bed of a propagating pit, it should be constructed with a division along the centre, running to within about a foot of the end, which should be left open to allow of the

water passing to the other side ; the flow pipe from the boiler should be connected with the end of the tank on one side of the central division, and the return pipe for leading the water back to the boiler should be connected at the same end on the other side of the division, a sufficient number of pipes being also connected with the flow and return pipes to heat the atmosphere to the temperature desired. It is convenient to have valves fixed in the flow and return pipes, so as to shut off bottom or top heat as may be required. In a larger house a tank may run along the front, across the end, and along the back to the end whence it started; and this may be either divided along the centre as in the former case, the water flowing the whole distance on one side the division and returning on the other, or a broad tank may occupy the front and back, and be connected at the end by an ordinary 4-inch pipe, the flow from the boiler being united with the front tank, and the return carried from the back tank into the boiler.

The tank system of heating is perhaps one of the readiest modes of supplying bottom heat to plunging beds either for propagating or for growing plants, though the same end is practically attained by running some of the ordinary 4-inch pipes connected with the heating apparatus through a tank which can be charged with water when necessary, and emptied when heat is not required. When the plan is used for supplying both top and bottom heat, provision must be made to prevent too much of the steam or vapour from passing into the house ; and, on account of the danger of having too much damp at certain seasons, it is no doubt preferable to have a separate set of pipes for the supply of atmospheric heat.

Solar heat.—The rays of the sun reflected from walls and other surfaces become a source of artificial heat. This species of heat, however, is materially affected by the admission of the air necessary to the health of the plants. Solar heat, if properly regulated by ventilation, is of immense importance in the ripening of all the finer fruits, as well as for the abundant development of blossoms in the case of flowering plants. In the orchard house, fruits are ripened by the influence of solar heat alone. To secure as much solar heat during the day as possible, the ventilators should be opened early in the morning, and closed early in the afternoon.

Ventilating Apparatus.—The object of ventilation in plant-culture is not so much to aid respiration as to carry off noxious vapours and to regulate the moisture and

temperature. The mechanical agitation both of the atmosphere and of the foliage caused by a free circulation, provided it be not too cold or too rudely admitted, has also a beneficial influence on the health of the plants. All ventilation, observes Mr M'Intosh (*Book of the Garden*, i. 271), "is founded upon the simple principle that cold air is heavier and has a tendency to sink downwards, while hot air is light and rises to the top. At first sight it may appear that, for the purpose of ventilating any building, it is only necessary that holes should be made at the bottom of the apartment for the air to enter, and other holes be placed in the upper part for the air to escape. Practically, however, ventilation is far from being so simple an affair," since currents of air are very difficult to direct or control, to moderate, or even to regulate with very great nicety. Too frequently air is given only during the day, and is excluded at night, often with an increase of fire-heat. Judicious horticulturists will reverse this, since plants require fresh air by night as well as by day, and in all countries cool nights succeed even the hottest days.

The mode of ventilating plant houses formerly in use was by letting down the top roof sashes, which was often supplemented by having the front or upright sashes also made movable, and more or less widely opened either outwards or laterally during the daytime. It is much more economical, however, and equally efficacious, to have the roof sashes fixed, and the top ventilation effected by means of a lantern in the case of a span-roofed house, or by horizontal ventilators near the top of the back wall in a lean-to. The front ventilation may be effected by openings in the front wall opposite the heating pipes, by which means the cold air is warmed, which is the best plan in all

houses where a high temperature has to be maintained, and is especially necessary in forcing-houses, on account of the risk of injury to the foliage from cold air ; or the front sashes may be made movable, which is better in temperate houses. In the case of pits, where there are no front sashes provided, the ventilators are sufficient for the purpose. The sliding down of one sash over the other, as once generally and even now frequently practised, greatly augments the shade in oblique sunshine, and is strongly objectionable on that account. The lantern mode of construction obviates this, but in a lean-to, and even with span roofs, it is better to have shorter movable sashes, hung so as to open by being elevated at the lower edge than to allow them to slide one over the other. A very slight elevation is sufficient for the egress of vitiated air.

One simple plan of warming the fresh air, recommended many years ago by Mr T. Moore (*Journ. Hort. Soc.*, i. 110), consists in passing the air after its admission by front ventilators through a heated chamber separate from the tank used as the heating medium, but admitting of communication with the tank chamber if necessary for the purpose of supplying moisture. The warmed fresh air is then led out in front of the tank, and carried forwards by the circulation up the slope of the roof, descending near the back wall to the floor, whence it is sucked into the heated chamber, mingling with the fresh air as it enters to repeat the circuit. A ventilator in the back wall provides the means of egress when this is required. Another plan, well adapted for forcing-houses, consists in fixing from end to end of the structure, below the hot-water pipes used for heating, a zinc or copper pipe of 6-inch or 8-inch diameter, and perforated with small holes, one end of the tube

passing through an outer wall, and being fitted with a valve which can be wholly or partly closed at pleasure. Other means of accomplishing the same end may be adopted to suit particular cases.

In order to secure the circulation of the confined air during the night, and thus to prevent an injurious rise of the temperature, and also to economize fuel, it is of advantage where practicable to use shutters. These should consist of a light frame, readily movable, and fitted so as to slide readily in grooves on a skeleton roof; and they should be covered with asphalted felt, or strong brown paper coated with tar, which is much used in Germany for covering purposes, and is both durable and cheap. This should form a close outer covering, so that the ventilators may be set open at bottom and top.

Formerly all ventilation had to be effected by the hand unaided, each sash being opened or shut separately, a matter of some urgency on the sudden outburst of sunshine. In all good ranges of glass, and in detached houses also, the work is now effected by machinery, many ingenious combinations of which are in use for this purpose.

Hygrometry.—For the healthy growth of plants, the regulation of the moisture is as necessary as the regulation of the heat. A considerable degree of moisture is necessary in the cases of most plants cultivated in a high temperature; but the amount varies of course in different cases, and this presents one of the principal difficulties in the management of what is called a mixed collection, whether of stove or greenhouse plants. In the case of fruits, where a house is mostly devoted to one subject, whether grapes, peaches, pines, or melons, the requisite conditions can be more readily secured. The instrument

with which the amount of moisture present in the atmosphere is measured is the hygrometer. The two hygrometers most generally used are Daniell's and the dry and wet bulb, the former a more delicate instrument, best adapted for scientific observations, the latter a simpler instrument, better adapted for horticultural purposes, because requiring less delicate manipulation. It consists of two thermometers mounted on one frame, the readings of which when uncovered should correspond. One bulb is left uncovered, the other is covered with muslin, and a few threads of cotton, with their other ends immersed in water, serve to keep it constantly moist. The temperature is lowered by the evaporation from the moistened bulb, and the difference in the readings of the two thermometers shows the degree of dryness. Mr Glaisher's instructions, which accompany the set of hygrometrical tables published by him, will be found of great assistance by every one making use of this instrument.

CHAPTER IV.

GARDEN MATERIALS AND APPLIANCES.



THE principal Soils used in gardens, either alone, or mixed to form what are called composts, are—Loam, Sand, Peat, Leaf-mould, and various mixtures and combinations of these made up to suit the different subjects under cultivation.

Loam is the staple soil for the gardener ; it is not only used extensively in the pure and simple state, but enters into most of the composts prepared specially for his plants. For garden purposes loam should be rather unctuous or soapy to the touch when moderately dry, not clinging nor adhesive, and should readily crumble when a compressed handful is thrown on the ground. If it clings together closely it is too heavy and requires amelioration by the admixture of gritty material ; if it has little or no cohesion when squeezed tightly in the hand, it is too light, and needs to be improved by the addition of heavier or clayey material. Sound friable loam cut one sod deep from the surface of a pasture, and stacked up for twelve months in a heap or ridge, is invaluable to the gardener. When employed for making vine borders, loam of a somewhat heavier nature can be used with advantage, on account of the porous materials which should accompany it. For stone fruits a calcareous loam is best ; indeed, for these subjects a rich calcareous loam used in a pure and simple

state cannot be surpassed. Somewhat heavy loams are best for potting pine apples, for melons and strawberries, and may be used with the addition of manures only; but for ornamental plants a loam of a somewhat freer texture is preferable and more pleasant to work. Loam which contains much red matter (iron) should be avoided.

Sand is by itself of little value except for striking cuttings, for which purpose fine clean sharp silver sand is the best; but for composts a coarser kind, if it is gritty, is to be preferred to the comminuted sands which contain a large proportion of earthy matter. River sand and the sharp grit washed up sometimes by the road side are excellent materials for laying around choice bulbs at planting time to prevent contact with earth which is perhaps manure-tainted. Sea sand may be advantageously used both for propagating purposes and for mixing in composts. For the growth of pot plants sand is an essential part of most composts, in order to give them the needful porosity to carry off all excess of moisture from the roots. If the finer earthy sands only are obtainable, they must be rendered sharper by washing away the earthy particles. Washed sand is best for all plants like heaths, which need a pure and lasting compost.

Peat soil is largely employed for the culture of American plants, as rhododendrons, azaleas, heaths, &c. In districts where heather and gritty soil predominate, the peat soil is poor and unprofitable, but selections from both the heathy and the richer peat soils, collected with judgment, and stored in a dry part of the compost yard, are essential ingredients in the cultivation of many choice pot plants, such as the Cape heaths and many of the Australian plants. Most monocotyledons do well in peat, even if they do not absolutely require it.

Leaf-mould is eminently suited for the growth of many free-growing plants, especially when it has been mixed with stable manure and has been subjected to fermentation for the formation of hot beds. In any state most plants feed greedily upon it, and when pure or free from decaying wood or sticks it is a very safe ingredient in composts; but it is so liable to generate fungus, and the mycelium or spawn of certain fungi is so injurious to the roots of trees, attacking them if at all sickly or weakened by drought, that many cultivators prefer not to mix leaf-mould with the soil used for permanent plants, as peaches or choice ornamental trees. For quick growing plants, however, as for example most annuals cultivated in pots, such as balsams, cockscombs, globe-amaranths, and the like, for cucumbers, and for young soft-wooded plants generally, it is exceedingly useful, both by preventing the consolidation of the soil and by acting as a manure. The accumulations of light earth formed on the surface in woods where the leaves fall and decay annually, consist of leaf-mould of the finest quality.

The material known as cocoa-nut fibre refuse is analogous to leaf soil, and may be employed for similar purposes. It should be mixed with gritty matter to favour the passage of water, and indeed requires to be so mixed when in an advanced stage of decay, in order to prevent its collapse into a close pasty mass. This cocoa-nut refuse is also a useful light material into which to plunge pots containing plants, as a preservative of the roots from the drying effects of the sun or the chilling effects of frost.

Composts are mixtures of the foregoing ingredients in varying proportions, and in combination with manures if necessary, so as to suit particular plants or classes of plants. The chief point to be borne in mind in making these mix-

tures is not to combine in the same compost any bodies that are antagonistic in their nature, as for example lime and ammonia. In making up composts for pot plants, the fibrous portion should not be removed by sifting, except for small sized pots, but the turfy portions should be broken up by hand and distributed in smaller or larger lumps throughout the mass. When sifting is had recourse to, the fibrous matter should be rubbed through the meshes of the sieve along with the earthy particles. Before being used the turfy ingredients of composts should lie together in a heap only long enough for the roots of the herbage to die, not to decompose.

Manures.—These are of two classes, organic and inorganic—the former being of animal and vegetable, the latter of mineral origin.

Farm-yard manure consists of the mixed dung of horses and cattle thrown together, and more or less soaked with liquid drainings of the stable or byre. It is no doubt the finest stimulant for the growth of plants, and that most adapted to restore the fertile elements which the plants have abstracted from exhausted soils. This manure is best fitted for garden use when in a moderately fermented state.

Horse dung is generally the principal ingredient in all hot bed manure; and, in its partially decomposed state, as afforded by exhausted hot beds, it is well adapted for garden use. It is most beneficial on cold stiff soils. It should not be allowed to lie too long unmoved when fresh, as it will then heat violently, and the ammonia is thus driven off. To avoid this, it should be turned over two or three times if practicable, and well moistened—preferably with farm-yard drainings.

Cow dung is less fertilizing than horse dung, but being slower in its action it is more durable; it is also cooler, and therefore better for hot dry soils. Thoroughly decayed, it is one of the best of all manures for mixing in composts for florists' flowers and other choice plants.

Pig dung is very powerful, containing more nitrogen than horse

dung ; it is therefore desirable that it should undergo moderate fermentation, which will be secured by mixing it with litter and a portion of earth. When weeds are thrown to the pigs, this fermentation becomes specially desirable to kill their seeds. The drainings of a pig-stye form a most valuable liquid manure for vegetable crops.

Night-soil is an excellent manure for all bulky crops, but requires to be mixed with earth or peat, or coal-ashes, so as both to deodorize it and to ensure its being equally distributed. Quick lime should not be used, as it dispels the greater part of the ammonia. When prepared by drying and mixing with various substances, night-soil is sold as *poudrette*, or desiccated night-soil, the value of which depends upon the materials used for admixture.

Malt-dust is an active manure frequently used as a top-dressing, especially for fruit trees in pots. It is rapid in its action, but its effects are not very permanent. *Rape dust* is somewhat similar in its character and action.

Bones are employed as a manure with decided advantage both to vegetable crops and to fruit trees, as well as to flowers. For turnips bone manure is invaluable. The effects of bones are no doubt mainly due to the phosphates they contain, and they are most effectual on dry soils. They are most quickly available when dissolved in sulphuric acid.

Guano is a valuable manure now much employed, and may be applied to almost every kind of crop with decided advantage. It should be mixed with six or eight times its weight of loam or ashes, charred peat, charcoal-dust, or some earthy matter, before it is applied to the soil, as from its causticity it is otherwise not unlikely to kill or injure the plants to which it is administered.

Pigeon dung approaches guano in its power as manure. It should be laid up in ridges of good loamy soil in alternate layers to form a compost, which becomes a valuable stimulant for any very choice subjects if cautiously used. The dung of the domestic fowl is very similar in character.

Horn, hoof-parings, woollen rags, fish, blubber, and blood are all good manures, and should be utilized if readily obtainable. *Sawdust* and *tan* are of less, indeed of little, value.

Liquid manure, consisting of the drainings of dung-heaps, stables, cowsheds, &c., or of urine collected from dwelling houses or other sources, is a most valuable and powerful stimulant, and can be readily applied to the roots of growing plants. The urine should be

allowed to putrefy, as in its decomposition a large amount of ammonia is formed, which should then be fixed by sulphuric acid or gypsum; or it may be applied to the growing crops after being freely diluted with water or absorbed in a compost heap. Liquid manures can be readily made from most of the solid manures when required, simply by admixture with water. When thus artificially compounded, unless for immediate use, they should be made strong for convenience of storage, and applied as required much diluted.

Ammonia is the most powerful of the manures of the inorganic series, and one of the most important of the constituents of manures generally, since it is the chief source whence plants derive their nitrogen. It is largely supplied in all the most fertilizing of organic manures, but when required in the inorganic state must be obtained from some of the salts of ammonia, as the sulphate, the muriate, or the phosphate, all of which, being extremely energetic, require to be used with great caution. These salts of ammonia may be used at the rate of from 2 to 3 cwt. per acre as a top-dressing in moist weather; dissolved in water they form active liquid manures.

Potash and *Soda* are also valuable inorganic manures in the form of carbonates, sulphates, silicates, and phosphates, but the most extensively employed is the nitrate of potash. The manures of this class are of course of value only in cases where the soil is naturally deficient in them. On this account the salts of soda are of less importance than those of potash. The value of wood ashes as a manure very much depends upon the carbonate and other salts of potash which they contain.

Lime in the caustic state is beneficially applied to soils which contain an excess of inert vegetable matter, and hence may be used for the improvement of old garden soils saturated with humus, or of peaty soils not thoroughly reclaimed. It does not supply the place of organic manures, but only renders that which is present available for the nourishment of the plants. It also improves the texture of clay soils.

Gypsum, or sulphate of lime, applied as a top-dressing at the rate of 2 to 3 cwt. per acre, has been found to yield good results, especially on light soils. It is also employed in the case of liquid manures to fix the ammonia.

Burnt Clay has a very beneficial effect on clay land by improving its texture and rendering soluble the alkaline substance it contains. The clay should be only slightly burnt, so as to make it crumble

down readily ; in fact, the fire should not be allowed to break through, but should be constantly repressed and kept smouldering by the addition of fresh material. The burning should be effected when the soil is dry.

Vegetable refuse of all kinds, when smother-burned in a similar way, becomes a valuable mechanical improver of the soil ; but the preferable course is to decompose it in a heap with quick lime and layers of earth, converting it into leaf-mould.

Soot forms a good top-dressing; it consists principally of charcoal, but contains ammonia, whence its value as a manure is derived. It should be kept dry until required for use. It may also be used in preventing the attacks of insects, such as the onion gnat and turnip fly, by dusting the plants or dressing the ground with it.

Common salt acts as a manure when used in moderate quantities, but in strong doses is injurious to vegetation. It suits many of the esculent crops, as onions, beans, cabbages, carrots, beet-root, asparagus, &c., the quantity applied varying from 5 to 10 bushels per acre. It is used as a top-dressing sown by the hand. Hyacinths and other bulbs derive benefit from slight doses, while to asparagus as much as 20 lb to the rood has been used with beneficial effect. At the rate of from 6 to 10 bushels to the acre it may be used on garden lawns to prevent worm casts. For the destruction of weeds on gravel walks or in paved yards a strong dose of salt, applied either dry or in solution, is found very effective, especially a hot solution, but after a time much of it becomes washed down, and the residue acts as a manure ; its continued application is undesirable, as gravel so treated becomes pasty

Tools, Implements, &c.—With regard to garden tools, instruments, implements, and machinery, it is only some of the more modern inventions and improvements that can be touched on here.

The two indispensable tools are the spade and the knife. The spade is commonly used for digging and trenching, but much of this work is now better done by means of Parkes's digging-



FIG. 42.—Parkes's Digging-Fork.

fork (fig. 42), which is both handier and lighter, and breaks up the ground better than the spade. The pickfork or Canterbury hoe (fig. 43) is a very useful tool for breaking up the surface soil, the three-pronged end being used for the looser parts, and the mattock end for breaking clods, or when the surface has become much consolidated. The drag (fig. 44) is also useful—a light three-pronged tool, which may be used for loosening the soil amongst vegetable crops as well as flower garden plants, and may also

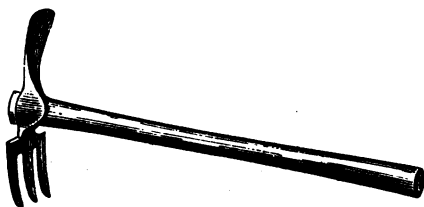


FIG. 43.—Pickfork.



FIG. 45.—Hand-Fork.

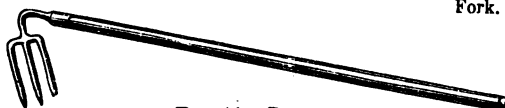


FIG. 44.—Drag.

be sometimes employed, if the tines are sufficiently narrow and pointed, to drag off weeds from the surface. The hand-fork (fig. 45), a short-handled three-tined implement, is extremely handy, either straight or bent at the socket, for many purposes, such as loosening weeds for hand-weeding, or for planting or transplanting small subjects; it is also very handy for plunging pots, either indoors or out, in tan beds, ash-beds, or common soil. Hoes and rakes made with a tapered neck and socket, into which the handle is fitted, do not clog so readily as when they are driven into a ferruled handle.

For pruning purposes a variety of instruments have been invented, under the names of *sécateurs*, pruning-shears, pruning-scissors, &c., but nothing equals a well-tempered old-fashioned knife, varied in form, strength, and size to suit the particular object to be operated on. The standard tree-pruner is a useful tool for cutting branches at a considerable elevation (12 to 15 feet) from the ground. Selby's flower gatherer (fig. 46), which cuts and holds the

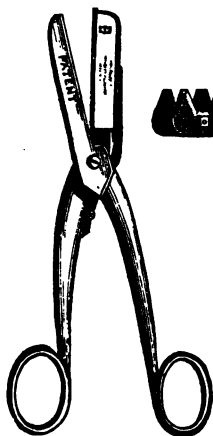


FIG. 46.—Selby's Flower Gatherer.

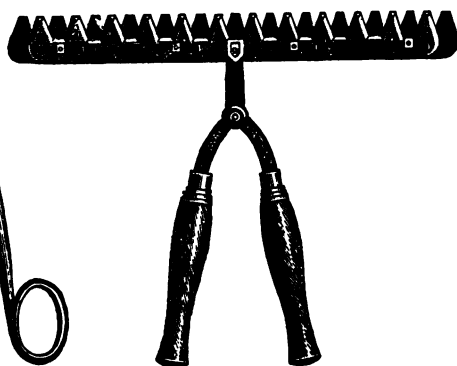


FIG. 47.—Ridgway's Hedge-Cutter.

flower at the same time, may be recommended, especially for the use of ladies. Some of the fruit gatherers also are ingenious and useful. A new instrument for clipping hedges, Ridgway's hedge-cutter (fig. 47), does its work quickly and well; and the same can be said for Adie's new lawn-edging machine.

For the destruction of insects Dean's and Appleby's and Dreschler's fumigators are all useful, but an equally efficient plan is to put a few live and glowing embers (preferably those

of charcoal) in a flower-pot, which is then to be raised on two bricks so placed as not to close the hole at the bottom ; on these embers moistened tobacco or tobacco paper is to be put, and over all damped moss. This will burn slowly and fill the house with smoke, care being taken that the material, as it dries, is lightly sprinkled with water, so that it does not burst into a flame.

Sulphurators are instruments for distributing flowers of sulphur, for the purpose of destroying mildew. In the

case of green-house plants, such as heaths, simply dusting with sulphur through a muslin bag or dredger is sufficient ; but in cases where vines are attacked with the *Oidium* or

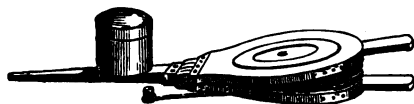


FIG. 48.—Sulphurator.

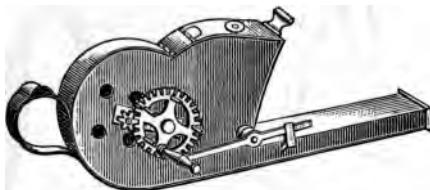


FIG. 49.—Epps's Sulphurator.

vine-mildew, the saving of the crop depends on the prompt diffusion of sulphur over all the affected parts, and this could not be so readily done by any other contrivance as by some of the forms of sulphurator (figs. 48, 49).

For the distribution of water in the form of spray, syringes are used, and of these there are none better than Read's patent, which acts by a piston and ball valve ; while for the more powerful garden engines, those manufactured by Read (fig. 50) and Warner have the preference.

Tallies of wood should be slightly smeared with white paint and then written on while damp with a black-lead

pencil. To preserve them from decay they should first be soaked in linseed oil, and after writing, the surface, when dry, may receive a thin coat of varnish. Zinc tallies are the best, on account of their durability, if written upon with a proper ink—12 grains of bichloride of platinum dis-



FIG. 50.—Read's Garden Engine.

solved in 1 oz. of distilled water. The zinc must be rubbed bright with fine emery paper before use. Larger labels of various materials and patterns are provided for trees and shrubs, and other permanent out-door plants. Lead labels with stamped figures are very useful for numbering pot

plants ; these may be wedge-shaped and bent over close to the pot-rim, and if the hollows are filled with white lead paint, and the surface cleaned off, they become very legible. Suspending labels for collections of out-door plants, whether of wood or metal, should be small and light, so that the suspending wire may not cut into the bark of the plants, and the ties must be occasionally loosened for the same reason. Zinc labels, like the Acme, with the names shown in relief are to be recommended when they can be obtained ready made, but are too expensive when they have to be specially prepared. A good durable and legible cheap garden label is, however, still a desideratum.

CHAPTER V.

GARDEN OPERATIONS.



THE propagation of plants, that is to say, their increase, so far as the production of new individuals of particular kinds is concerned, is one of the most important and constantly recurring of gardening operations. In effecting this, various processes are adopted, which will now be described.

(1) *By Seeds.*—This may be called the natural means of increasing the number of any particular kind of plant, but it is to be remembered that we do not by that means secure an exact reproduction of the parent. We may get a progeny very closely resembling it, yet each plant possessing a distinct individuality of its own; or we may get a progeny very unlike the parent, or a mixed progeny showing various degrees of divergence. Many seeds will grow freely if sown in a partially ripened state; but as a general rule seeds have to be kept for some weeks or months in store, and hence they should be thoroughly ripened before being gathered. They should be sown in fine rich soil, such as will not readily get consolidated. In the case of outdoor crops, if the soil is inclined to be heavy, it is a good plan to cover the smaller seeds with a light compost. Very small seeds should only have a sprinkling of light earth or sand over them, and sometimes only a thin layer of soft moss to exclude light and preserve an equable degree of moisture. Somewhat larger seeds sown indoors may be covered to the depth of one-eighth or one-fourth of an inch, according to their size. Outdoor crops require to be sown, the smaller seeds from half an inch to an inch, and the larger ones from 2 to 4 inches under the surface, the covering of the smaller ones especially being light and open. Many seeds grow well when raked in; that is,

the surface on which they are scattered is raked backwards and forwards until most of them are covered. Whatever the seeds, the ground should be made tolerably firm both beneath and above them, which may be done by treading in the case of most kitchen garden crops, which are also better sown in drills—a plan admitting the more readily of the ground being kept clear of weeds by hosing. All seeds require a certain degree of heat to induce germination. For tropical plants the heat of a propagating house—75° to 80°, with a bottom heat of 80° to 90°—is desirable, and in many cases absolutely necessary; for others, such as half-hardy annuals, a mild hot bed, or a temperate pit ranging from 60° to 70°, is convenient; while of course all outdoor crops have to submit to the natural temperature of the season. It is very important that seeds should be sown when the ground is in a good working or friable condition, and not clammy with moisture.

(2) *By Offsets*.—This mode of increase applies specially to bulbous plants, such as the lily and hyacinth, which produce little bulbs on the exterior round their base. Most bulbs do so naturally to a limited but variable extent; when more rapid increase is wanted the heart is destroyed, and this induces the formation of a larger number of offsets. The stem bulbs of lilies are similar in character to the offsets from the parent bulb. The same mode of increase occurs in the gladiolus and crocus, but their bulb-like permanent parts are called corms, not bulbs. After they have ripened in connexion with the parent bulb, the offsets are taken off, stored in appropriate places, and at the proper season planted out in nursery beds.

(3) *By Tubers*.—The tuber is a fleshy underground stem, variable in form, furnished with eyes which are either visible, as in the potato and some familiar kinds of *Tropæolum* (*T. tuberosum*) and *Oxalis* (*O. crenata*), or latent, as in the Chinese yam (*Dioscorea Batatas*), and from which young shoots arise. When used for propagation, the tubers are cut up into what are called “sets,” every portion having an eye attached being capable of forming an independent plant. The cut portions of bulky sets should be suffered to lie a short time before being planted, in order to dry the surface and prevent rotting; this should not, however, be done with such tropical subjects as caladiums, the tubers of which are often cut up into very small fragments for propagation, and of course require to be manipulated in a properly heated propagating pit. No eyes are visible in the Chinese yam, but slices of the long club-shaped tubers

will push out young shoots and form independent plants, if planted with ordinary care.

(4) *By Division*.—Division, or partition, is usually resorted to in the case of tufted growing plants, chiefly perennial herbs; they may be evergreen, as chamomile or thrift, or when dormant may consist only of underground crowns, as larkspur or lily-of-the-valley; but in either case the old tufted plant being dug up may be divided into separate pieces, each furnished with roots, and, when replanted, will generally start on its own account without much check. Suffruticose plants and even small shrubs may be propagated in this way, by first planting them deeper than they are ordinarily grown, and then after the lapse of a year, which time they require to get rooted, taking them up again and dividing them into parts or separate plants. Box-edging, sage, and southernwood are examples. The same end may sometimes be effected by merely working fine soil in amongst the base of the stems, and giving them time to throw out roots before parting them.

(5) *By Suckers*.—Root suckers are young shoots from the roots of plants, chiefly woody plants, such as may often be seen in the case of the elm and the plum. The shoots when used for propagation must be transplanted with all the roots attached to them, care being taken not to injure the parent plant. If they spring from a thick root it is not to be wantonly severed, but the soil should be removed and the sucker taken off by cutting away a clean slice of the root, which will then heal and sustain no harm. Stem suckers are such as proceed from the base of the stem, as is often



FIG. 51.—Suckering Iron.

seen in the case of the currant and lilac; these should be removed in any case, and if required for propagation they should be taken with all the roots attached to them, and should be as thoroughly disbudged below ground as possible, or they will be liable to continue the habit of suckering. In this case, too, the soil should be carefully opened and the shoots removed with a suckering iron, a sharp concave implement with long iron handle (fig. 51). When the number of roots is limited, the tops should be shortened, and some care in watering and mulching should be bestowed on the young plants if they are of any considerable value.

(6) *By Runners*.—Runners are slender prostrate stems, rooting at

the joints as they grow on. The young string-like shoots produced by the strawberry are a well-known example of them. The process of rooting these runners should be facilitated by fixing them close down to the soil, which is done by small wooden hooked pegs or by stones; hair-pins, short lengths of bent wire, &c., may also be used. After the roots are formed, the strings are cut through, and the runners become independent plants.

(7) *By Proliferous Buds*.—Not unlike the runner, though growing in a very different way, are the bud-plants formed on the fronds of several kinds of ferns belonging to the genera *Asplenium*, *Woodwardia*, *Polystichum*, *Lastrea*, *Adiantum*, *Cystopteris*, &c. In some of these (*Adiantum caudatum*, *Polystichum lepidocaulon*) the rachis of the frond is lengthened out much like the string of the strawberry runner, and bears a plant at its apex. In others (*Polystichum angulare proliferum*), the stipes below and the rachis amongst the pinnæ develop buds, which are often numerous and crowded. In others again (*Woodwardia orientalis*, *Asplenium bulbiferum*), buds are numerous produced on the upper surface of the fronds. These will develop on the plant if allowed to remain. For propagation the bulbiferous portion is pegged down on the surface of a pot of suitable soil; if kept close in a moist atmosphere, the little buds will soon strike root and form independent plants. In the *Cystopteris* the buds are deciduous, falling off as the fronds acquire maturity, but, if collected and pressed into the surface of a pot of soil and kept close, they will grow up into nice young plants the following season.

(8) *By Layers*.—Layering consists in preparing the branch of a plant while still attached to the parent, bending it so that the part operated on is brought under ground, and then fixing it there by means of a forked peg. Some plants root so freely that they need only pegging down; but in most cases the arrest of the returning sap to form a callus, and ultimately young roots, must be brought about artificially, either by twisting the branch, by splitting it, by girdling it closely with wire, by taking off a ring of bark, or by "tonguing." In tonguing, the leaves are cut off the portion which has to be brought under ground, and a tongue or slit is then cut from below upwards close beyond a joint, of such length that, when the cut part of the layer is pegged an inch or two (or in larger woody subjects 3 or 4 inches) below the surface, the elevation of the point of the shoot to an upright position may open the incision, and thus set it free, so that it may be surrounded

by earth to induce it to form roots. The whole branch, except a few buds at the extremity, is covered with soil. The best seasons for these operations are early spring and midsummer, that is, before the sap begins to flow, and after the first flush of growth has passed off. One whole summer, sometimes two, must elapse before the layers will be fully rooted in the case of woody plants; but such plants as carnations and picotees, which are usually propagated in this way, in favourable seasons take only a few weeks to root, as they are layered towards the end of the blooming season in July, and are taken off and planted separately early in the autumn. Fig. 52 shows a woody plant with one layer prepared by tonguing and another by ringing.

In general, each shoot makes one layer, but in plants like the

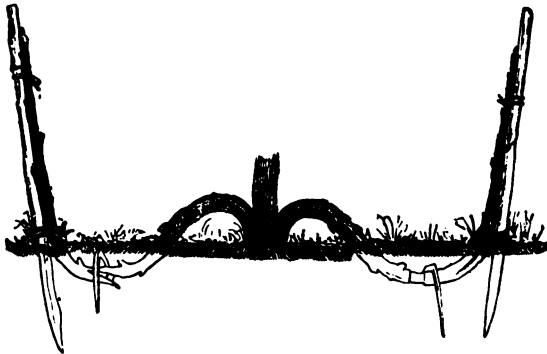


FIG. 52.—Propagation by Layers—*a*, tonguing; *b*, ringing.

Wistaria or *Clematis*, which make long shoots, what is called serpentine layering may be adopted; that is, the shoot is taken alternately below and above the surface, as frequently as its length permits. There must, however, be a joint at the underground part where it is to be tongued and pegged, and at least one sound bud in each exposed part, from which a shoot may be developed to form the top of the young plant.

(9) *By Circumposition*.—When a plant is too high or its habit does not conveniently admit of its being layered, it may often be increased by what is called circumposition, the soil being carried up to the branch operated on. The branch is to be prepared by ringing or notching or wiring as in layering, and a temporary stand made to support the vessel which is to contain the soil.

The vessel may be a flower-pot sawn in two, so that the halves may be bound together when used, or it may be a flower-pot or box with a side slit which will admit the shoot; this vessel is to be filled compactly with suitable porous earth, the opening at the slit being stopped by pieces of slate or tile. The earth must be kept moist, which is perhaps best done by a thick mulching of moss, the moss being also bound closely over the openings in the vessel, and all being kept damp by frequent syringings. Reid remarks of this method of propagation that he has effected it with clay and cow dung, well mixed, after the bark had been taken off all round, and wrapped about with a double or triple swaddling of straw or hay ropes (*Scots Gardener*, A.D. 1721).

This process is sometimes found very useful in the case of choice conservatory plants which may be getting too tall for the house, such as a fine *Dracæna* (fig. 53) or *Yucca*. Such a plant may be operated on wherever the stem has become firm and woody; the top will not fail to make a fine young specimen plant, which might be removed in the course of about twelve months, while other shoots would no doubt be obtained from the old stem, which, with its head thus reduced, might be removed to quarters where it would not be an eyesore. The head would perhaps require steady-
ing if the stem were loaded with a pot or box of soil, as at *a* in

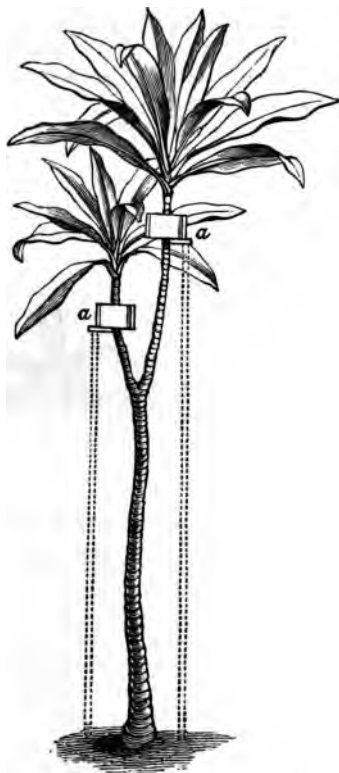


Fig. 53.

the figure. Mr Bain records (*Pact. Mag. Bot.*, xvi. 46) a successful experiment of this kind with a *Dracæna Draco* which was getting too tall for its position. An incision was made in the stem half an inch deep to the extent of half its circumference, lime being applied to the wound to dry up the sap. This incision was from time to time deepened (and lime-dried) until severed, the top being suspended from the roof. After some months roots were protruded from between the woody structure and its bark-like covering, and the gigantic cutting was lowered into its place, and grew away freely. In this case Mr Bain was of opinion that success was due to the slowness of the process, and the precautions taken to dry and harden the stem.

(10) *By Grafts*.—Grafting is so extensively resorted to that it is impossible here to notice all its phases. It is perhaps of most importance as the principal means of propagating our hardy kinds of fruit, especially the apple and the pear; but the process is the same with most other fruits and ornamental hardy trees and shrubs that are thus propagated. The fruit stocks are commonly divided into two classes:—(1) free stocks, which consist of seedling plants, chiefly of the same genus or species as the trees from which the scions are taken; and (2) dwarfing stocks, which are of more diminutive growth, either varieties of the same species or species of the same or some allied genus as the scion, which have a tendency to lessen the expansion of the engrafted tree. The French Paradise is the best dwarfing stock for apples, and the quince for pears. In determining the choice of stocks, the nature of the soil in which the grafted trees are to grow should have full weight. In a soil, for example, naturally moist, it is proper to graft pears on the quince, because this plant not only thrives in such a soil, but serves to check the luxuriance thereby produced. The scions should always be portions of the wood of the preceding year, selected from healthy parents; in the case of shy-bearing kinds, it is better to obtain them from the fruitful branches. The scions should be taken off some weeks before they are wanted, and half-buried in the earth, since the stock at the time of grafting should in point of vegetation be somewhat in advance of the graft. During winter, grafts may be conveyed long distances, if carefully packed. If they have been six weeks or two months separated from the parent plant, they should be grafted low on the stock, and the earth should be ridged up round them, leaving only one bud of the scion exposed above ground. The best season for grafting apples and similar

hardy subjects is the month of March ; but it may be commenced as soon as the sap in the stock is fairly in motion, and may be continued during the first half of April.

Whip-grafting or Tongue-grafting (fig. 54) is the most usual mode of performing the operation. The stock is headed off by an oblique transverse cut as shown at *a*, a slice is then pared off the side as at *b*, and on the face of this a tongue or notch is made, the cut being in a downward direction ; the scion *c* is pared off in a similar way by a single clean sharp cut, and this is notched or tongued in the

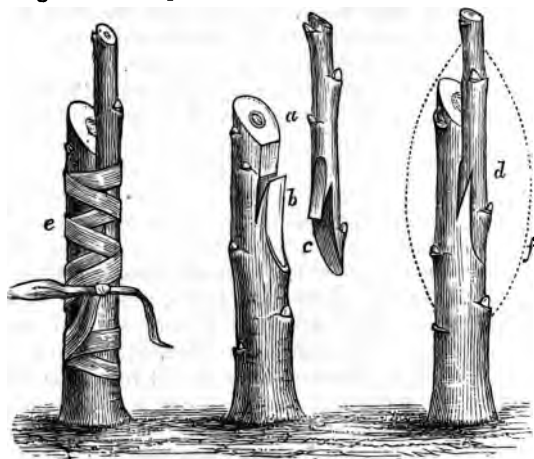


FIG. 54.—Whip-Grafting or Tongue-Grafting.

opposite direction as the figure indicates ; the two are then fitted together as shown at *d*, so that the inner bark of each may come in contact at least on one side, and then tied round with damp soft bast as at *e* ; next some grafting clay is taken on the forefinger and pushed down on each side so as to fill out the space between the top of the stock and the graft, and a portion is also rubbed over the ligatures on the side where the graft is placed, a handful of the clay is then taken, flattened out, and rolled closely round the whole point of junction, being finished off to a tapering form both above and below, as shown by the dotted line *f*. To do this deftly, the hands should be plunged from time to time in dry ashes, to prevent the clay from sticking to them.

Cleft-grafting.—(fig. 55) is another method in common use. The

stock is cleft down from the horizontal cut *d*, and the scion, when cut to a thin wedge form, as shown at *c* and *e*, is inserted into the cleft; the whole is then bound up and clayed as in the former case. This is not so good a plan as whip-grafting; it is improved by sloping the stock on one side to the size of the graft.

Crown-grafting or *Rind-grafting* (fig. 56) is preferable to cleft-grafting, inasmuch as it leaves no open spaces in the wood. The stock is cut off horizontally or nearly so, and a slit is then cut in the bark *f f*, a wedge-shaped piece of ivory being inserted to raise the bark; the scion is then cut to the same wedge-shaped form *g, h*, and inserted in the space opened for it between the

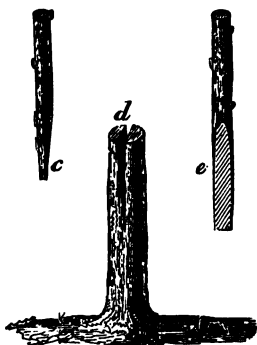


FIG. 55.—Cleft-Grafting.

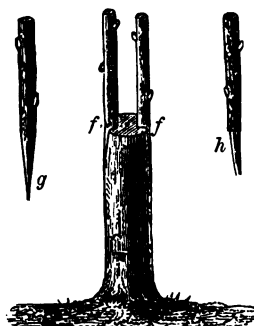


FIG. 56.—Crown-Grafting.

albumen and the bark, after which it is tied down and clayed over in the manner already described.

Side-grafting is performed like whip-grafting, the graft being inserted on the side of a branch and not at the cut end of the stock. It may be practised for the purpose of changing a part of the tree, and is sometimes very useful for filling out vacant spaces, in trained trees especially.

Inarching is another form of side-grafting. Here the graft is fixed to the side of the stock, which is planted or potted close to the plant to be worked. The branches are applied to the stock while yet attached to the parent tree, and remain so until united. In the case of trained trees, a young shoot is sometimes inarched to its parent stem to supply a branch where one has not been developed in the ordinary way.

For the propagation by grafts of stove and greenhouse plants the

process adopted is whip-grafting or a modification of it. The parts are, however, sometimes so small that the tongue of the graft is dispensed with, and the two stems simply pared smooth and bound together. In this way hardy rhododendrons of choice sorts, greenhouse azaleas, the varieties of the orange family, camellias, roses, rare conifers, and numerous other plants are increased. In small subjects soft cotton is used for tying instead of bast, and grafting-wax is substituted for grafting-clay. The best is the French cold



FIG. 57.—Root-Grafting of Dahlia.

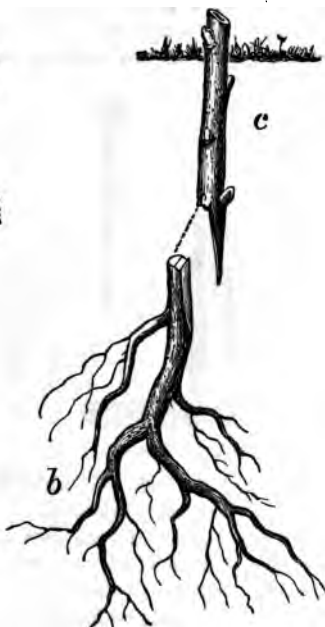


FIG. 58.—Root-Grafting of Woody Plant.

mastic "L'Homme Lefort." All grafting of this kind is done in the propagating house, at any season when grafts are obtainable in a fit state,—the plants when operated on being placed in close frames warmed to a suitable temperature.

Root-grafting is sometimes resorted to where extensive increase is an object, or where stem-grafting or other means of propagation are not available. In this case the scion is grafted directly on to a

portion of the root of some appropriate stock, both graft and stock being usually very small; the grafted root is then potted so as to cover the point of junction with the soil, and is plunged in the bed of the propagating house, where it gets the slight stimulus of a gentle bottom heat. Dahlias (fig. 57) and pæonies may be grafted by inserting young shoots into the neck of one of the fleshy roots of each kind respectively—the best method of doing so being to cut a triangular section near the upper end of the root, just large enough to admit the young shoot when slightly pared away on two sides to give it a similar form. In the case of large woody plants thus worked (fig. 58) the grafted roots, after the operation is completed,

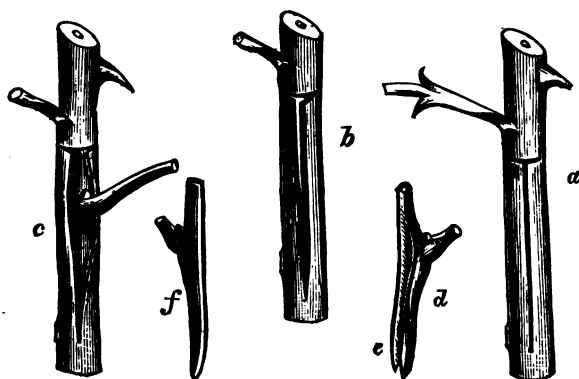


FIG. 59.—Shield-Budding.

are planted in nursery beds, so that the upper buds only are exposed to the atmosphere, as shown at *c* in the figure.

(11) *By Buds*.—Budding is the inserting of a bud cut with a portion of bark of the plant to be propagated into the bark of the stock, where it is bound gently but firmly. Stone fruits, such as peaches, apricots, plums, cherries, &c., are propagated in this way, as well as roses, and many other plants. In the propagating house budding may be done at any season when the sap is in motion; but for fruit trees, roses, &c., in the open air, it is usually done in July or August, when the buds destined for the following year are completely formed in the axils of the leaves, and when the bark separates freely from the wood it covers. Those buds are to be preferred, as being best ripened, which occur on the middle portion of a young shoot.

The simplest and most generally practised form of budding is

that called *Shield-budding* or *T-budding* (fig. 59). The operator should be provided with a budding-knife in which the cutting-edge of the blade is rounded off at the point, and which has a thin ivory or bone handle, for raising the bark of the stock. A horizontal incision is made in the bark quite down to the wood, and from this a perpendicular slit is drawn downwards to the extent of perhaps an inch, so that the slit has a resemblance to the letter T, as at *a*. A bud is then cut by a clean incision from the tree intended to be propagated, having a portion of the wood attached to it, and so that the whole may be an inch and a half long, as at *d*. The bit of wood *e* must be gently withdrawn, care being taken that the bud adheres wholly to the bark or shield, as it is called, of which *f* is a side view. The bark on each side of the perpendicular slit being then cautiously opened, as at *b*, with the handle of the knife, the bud and shield are inserted as shown at *c*. The upper tip of the shield is cut off horizontally, and brought to fit the bark of the stock at the transverse incision. Slight ties of soft cotton wool or worsted, or even moist bast-matting, are then applied. In about a month or six weeks the ligatures may be taken away, when, if the operation has been successful, the bud will be fresh and full, and the shield firmly united to the wood. In the following spring a strong shoot will be thrown out, and to this the stock is headed down by gradations during the course of the summer.

To be successful the operation should be performed with a quick and light hand, so that no part of the delicate tissues be injured, as would happen if they were left for a time exposed, or if the bud were forced in like a wedge. The union is effected as in grafting, by means of the organizable sap or cambium, and the less this is disturbed until the inner bark of the shield is pressed and fixed against it the better. Inverted T-budding, in which the two incisions are in the form **L**, is for some reasons preferable to the more ordinary method.

(12) *By Branch Cuttings*.—Propagation by cuttings is the mode of increase most commonly adopted, next to that by seeds. It is effected by taking a portion from a branch or shoot of the plant, and placing it in the soil. There are great differences to be observed in the selection and treatment of cuttings. Sometimes soft green shoots, as in *Verbena* (fig. 60, *a*), are used; sometimes the shoots must be half-ripened, and sometimes fully matured. So of the mode of preparation; some will root if cut off or broken off at any point and thrust into wet earth or sand in a warm place (fig. 60, *a*); others

require to be cut with the utmost care just below a joint or leaf-base, and by a keen blade so as to sever the tissues without tearing or bruising; and others again after being cut across require to be split up for a short distance. It is usual and in most cases necessary to cut away the lower portion of a cutting up to just below the node or joint (fig. 60, *b*, *d*, *e*). The internodal parts will not often divide so as to form separate individual plants; sometimes, however, this happens; it is said that the smallest piece of *Torenia asiatica*, for instance, will grow. Then as to position, certain cuttings grow readily enough if planted outdoors in the open soil, some preferring

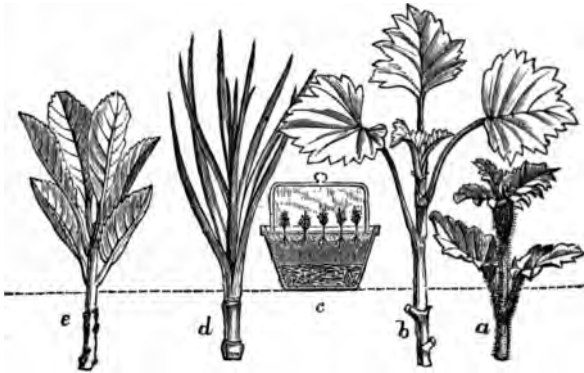


FIG. 60.—Propagation by Cuttings.

shade, others sunshine, while less hardy subjects must be covered with a bell-glass, or must be in a close atmosphere with bottom heat, or must have the aid of pure silver sand to facilitate their rooting (fig. 60, *c*). Cuttings should in all cases be taken from healthy plants, and from shoots of a moderate degree of vigour. It is also important to select leafy growths, and not such as will at once run up to flower. Young shoots which have become moderately firm generally make the best cuttings, but sometimes the very softest shoots strike more readily. For all plants in an active growing state spring is the safest time for taking cuttings.

Cuttings of deciduous plants should be taken off after the fall of the leaf, and should have all underground buds carefully removed so as to prevent as far as possible the formation of suckers. These cuttings should be about one foot in length, and should be planted at once in the ground so as to leave only the top with the two or

three preserved buds exposed. If a clean stem, however, is desired, a longer portion may be left uncovered.

Cuttings of growing plants are prepared by removing with a sharp knife, and moderately close, the few leaves which would otherwise be buried in the soil, and then cutting them clean across just below a joint; the fewer the leaves thus removed, however, the better, as if kept from being exhausted they help to supply the organizable matter out of which the roots are formed. Free-rooting subjects strike in any lightish sandy mixture; but difficult subjects should have thoroughly well-drained pots, a portion of the soil proper for the particular plants made very sandy, and a surfacing of clean sharp silver sand about as deep as the length of the cutting (fig. 60, c). Mr Ayres, writing in the *Gardeners' Chronicle* (1843, p. 116), recommends 5-inch pots for cuttings; and these he prepares by placing over the hole at the bottom of each an inverted 3-inch pot, around it potsherds broken small, over these some moss, and then the compost made up of equal quantities of peat, sand, and leaf-mould, leaving about half an inch at top for white sand, which runs into the holes as the cuttings are inserted. Mr Ayres advises that "a stock of pots thus prepared should be kept in a frame or propagating house, as nothing is so injurious to cuttings taken from plants growing in heat as to put them into cold soil. Cuttings cannot be too short if they have the necessary buds to form a plant; neither can they be inserted too shallow, if they are made firm in the pots." All plants while striking may be kept in a temperature rather higher than that in which they grow naturally, and the soil about them should be kept moist, although they must not from want of drainage in any degree get sodden with wet. The humidity kept up about the cuttings is maintained by covering them with bell-glasses, or setting them in handlights or small glazed frames of convenient size.

A special contrivance for a cutting pot (fig. 61) was brought into notice many years ago by Mr A. Forsyth. A smaller pot was put into a larger one, the hole at the bottom being closed with clay *a*; the bottom of the outer pot

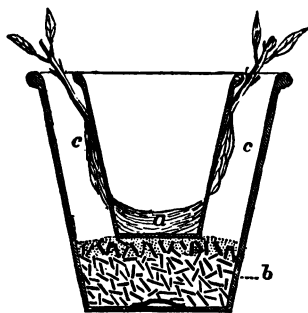


FIG. 61.—Double Cutting Pot.

is filled with crocks *b*, so that the small pot is brought up to the level of the larger one; and the space between the two pots *c* is filled with propagating soil, the cuttings being so planted that their ends rest against the sides of the inner pot, which is then filled with water, and this passing slowly through the sides of the pot, just keeps the soil moistened.

Such delicate plants as heaths are reared in silver sand, a stratum of which is placed over the sandy peat soil in the cutting pot, and thus the cuttings, though rooting in the sand, find at once on the emission of roots congenial soil for them to grow in (fig. 60, *e*).

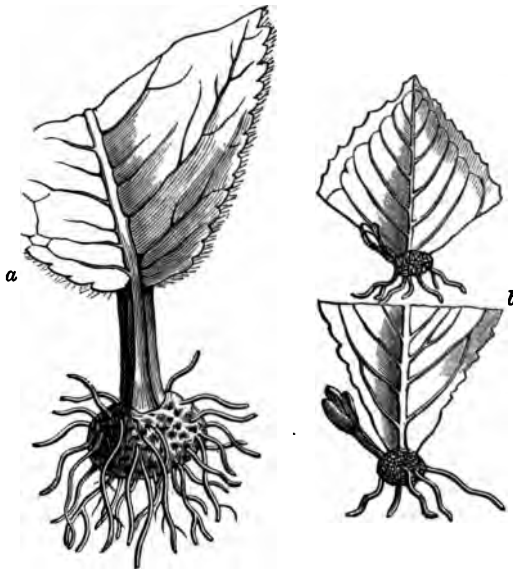


FIG. 62.—Leaf Cuttings.

Hardy plants, such as pinks, pansies, &c., are propagated by cuttings planted during early summer in light rich soil. The cuttings of pinks are called pipings (fig. 60, *d*), and are planted about June, while pansies may be renewed in this way both in spring and in autumn.

(18) *By Leaf Cuttings*.—Many plants may be propagated by planting their leaves or portions of their leaves as cuttings, as, for example, the herbaceous *Gloxinia* (fig. 62, *a*) and *Gesnera*, the

succulent *Sempervivum*, *Echeveria*, *Pachyphytum*, and their allies, and such hard-leaved plants as *Theophrasta* (fig. 62, b). The leaves are best taken off with the base whole, and should be planted in well-drained sandy soil; in due time they form roots, and ultimately, from some latent bud, a little shoot which forms the young plant. The treatment is precisely like that of branch cuttings. Gloxinias, begonias, &c., grow readily from fragments of the leaves cut clean through the thick veins and ribs, and planted edgewise like cuttings. This class of subjects may also be fixed flat on the surface of the cutting pot, by means of little pegs or hooks, the main ribs being cut across at intervals, and from these points roots, and eventually young tubers, will be produced (fig. 63).



Fig. 63.—Leaf Propagation.

(14) *By Root Cuttings*.—Some plants which are not easily increased by other means propagate readily from root cuttings. Amongst the indoor plants which may be so treated, the *Bouvardia*, *Pelargonium*, *Aralia*, and *Wigandia* may be mentioned. The *modus operandi* is to turn the plant out of its pot, shake away the soil so as to free the roots, and then select as many pieces of the stouter roots as may be required. These are cut up into half-inch lengths (sometimes less), and inserted in light sandy soil round the margin of a cutting pot, so that the upper end of the root cutting may be level with the soil or only just covered by it. The pots should be watered so as to settle the soil, and be placed in the close atmosphere of the propagating pit or frame, where they will need scarcely any water until the buds are seen pushing through the surface.

There are various herbaceous plants which may be similarly treated, such as sea-kale and horseradish, and, among ornamental plants, the beautiful autumn-blooming *Anemone japonica* and *Senecio pulcher*. The sea-kale and horseradish, require to be treated in the open garden, where the cut portions should be planted in lines in well-worked soil; but the roots of the *Anemone* and *Senecio* should be planted in pots and kept in a close frame with a little warmth till the young shoots have started.

Various hardy ornamental trees are also increased in this way, as the quince, elm, robinia, and mulberry, and the rose amongst shrubs. The most important use to which this mode of propagation

is put is, however, the increase of roses, and of the various plums used as stocks for working the choicer stone fruits. The method in the latter case is to select roots averaging the thickness of the little finger, to cut these into lengths of about 3 or 4 inches, and to plant them in lines just beneath the surface in nursery beds. The root cuttings of rose-stocks are prepared and treated in a similar way.

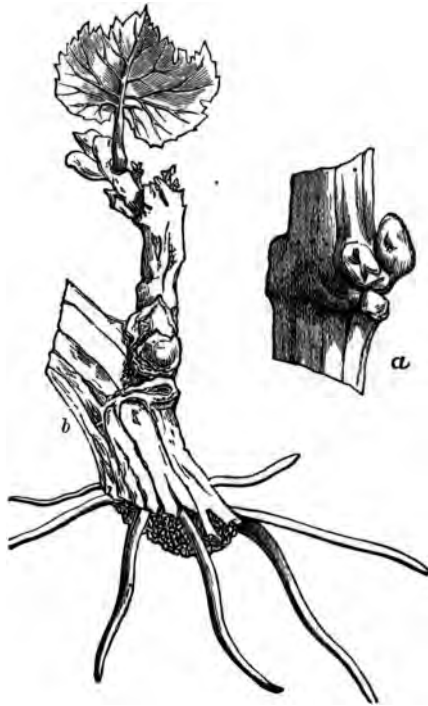


FIG. 64.—Cutting of Single Eye.

(15) *By Cuttings of Single Eyes.*—This mode of propagation is performed by cutting the branches into short lengths, each containing one well-matured bud or eye, with a short portion of the stem above and below. It is a common mode of propagating vines, the eyes being in this case cut from the ripened leafless wood. The eyes (fig. 64, *a*) are planted just below the surface in pots of light soil,

which are placed in a hot bed or propagating pit, and in due time each pushes up a young shoot which forms the future stem, while from about its base the young roots are produced (fig. 64, *b*) which convert it into an independent plant. In the case of plants with persistent leaves, the stem may be cut through just above and below the bud, retaining the leaf which is left on the cutting, the old wood and eye being placed beneath the soil and the leaf left exposed. In this way the india-rubber tree (*Ficus elastica*), for example, and many other tender plants may be increased with the aid of a brisk bottom heat. Many of the free-growing soft-wooded plants may also be grown from cuttings of single joints of the young wood, where rapid increase is desired ; and in the case of opposite-leaved plants two cuttings may often be made from one joint by splitting the stem longitudinally, each cutting consisting of a leaf and a perfect bud attached to half the thickness of the stem.

Planting and Transplanting.—In preparing a fruit tree for transplantation, the first thing to be done is to open a trench round it at a distance of from 3 to 4 feet, according to size. The trench should be opened to about two spades' depth, and any coarse roots which may extend thus far from the trunk may be cut clean off with a sharp knife. The soil between the trench and the stem is to be reduced as far as may seem necessary or practicable by means of a digging fork, the roots as soon as they are liberated being fixed on one side and carefully preserved. By working in this way all round the ball, the best roots will be got out and preserved, and the ball lightened of all superfluous soil. The tree will then be ready to lift if carefully prized up from beneath the ball, and if it does not lift readily, it will probably be found that a root has struck downwards, which will have to be sought out and cut through. Whenever practicable, it is best to secure a ball of earth round the roots. On the tree being lifted from its hole the roots should be examined, and all which have been severed roughly with the spade should

have the ends cut smooth with the knife to facilitate the emission of fibres. The tree can then be transported to its new position. The hole for its reception should be of sufficient depth to allow the base of the ball of earth, or of the roots, to stand so that the point whence the uppermost roots spring from the stem may be 2 or 3 inches above the general surface level. Then the bottom being regulated so as to leave the soil rather highest in the centre, the plant is to be set in the hole in the position desired, and steadied there by hand. Next the roots from the lower portion of the ball are to be sought out and laid outwards in lines radiating from the stem, being distributed equally on all sides as nearly as this can be done; some fine and suitable good earth should be thrown amongst the roots as they are thus being placed, and worked in well up to the base of the ball. The soil covering the roots may be gently pressed down, but the tree should not be pulled up and down, as is sometimes done, to settle the soil. This done, another set of roots higher up the ball must be laid out in the same way, and again another, until the whole of the roots, thus carefully laid, are embedded as firmly as may be in the soil, which may now receive another gentle treading. The stem should next be supported permanently, either by one stake or by three, according to its size. The excavation will now be filled up about two-thirds perhaps; and if so the tree may have a thorough good watering, sufficient to settle the soil closely about its roots. After twenty-four hours the hole may be levelled in, with moderate treading, if the water has soaked well in, the surface being left slightly sloping upwards towards the stem of the tree. In transplanting trees of the ornamental class, less need be attempted in

respect to providing new soil, although the soil should be made as congenial as practicable.

In transplanting smaller subjects, such as plants for the flower garden, much less effort is required. The plant must be lifted with as little injury to its rootlets as possible, and carefully set into the hole, the soil being filled in round it, and carefully pressed close by the hand. For moving small plants the garden trowel is a very convenient tool, but we are inclined to give the preference to the hand-fork (fig. 45). For larger masses, such as strong-growing herbaceous plants, a spade or digging-fork will be requisite.

When seedlings of vigorous plants have to be "pricked out," a dibble is the best implement to be used.

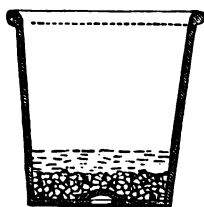


The ground being prepared and, if necessary, enriched, and the surface made fine and smooth, a hole is made with the dibble deep enough and large enough to receive the roots of the seedling plants without doubling them up, and the hole is filled in by working the soil close to the plant with the point of the dibble. The pricking out of seedlings in pots in the propagating pit is effected in a similar way. The plants, indeed, often require to be removed and set from half an inch to an inch apart before they have become sufficiently developed to admit of being handled with any degree of facility, and for these a pointed stick of convenient size is used as a dibble. In extreme cases it is best to lift the little seedling on the end of a flattish pointed stick, pressing this into the new soil where the plant is to be placed, and liberating it and closing the earth about it by the aid of a similar stick held in the other hand.

Large trees may be successfully transplanted by the aid of transplanting machines, of which different forms are in

use. These will be found figured and described in the various horticultural and arboricultural publications. See, e.g., M'Intosh's *Book of the Garden* (ii. p. 374 sq.). The best season for transplanting deciduous trees is during the early autumn months. As regards evergreens opinions are divided, some preferring August and September, others April or May. They can be successfully planted at either period, but for subjects which are at all difficult to remove the spring months are to be preferred.

Potting and Repotting.—Garden pots are made with a comparatively large hole in the bottom, and those of the largest size have also holes at the side near the bottom; these openings are to prevent the soil becoming saturated or soured with superabundant water. To prepare the pot for the plant, a broadish piece of potsherd, called a "crock," is placed over the large hole, and if there be side holes they also are covered. The bottom crock is made from a piece of a broken garden pot, and is laid with the convex side upwards; then comes a layer of irregular pieces of crock of various sizes, about an inch deep in a 5-inch pot, 2 inches in an 11-inch or 12-inch pot, &c. The mode of crocking a pot is shown in fig. 65. A few of the coarser lumps from the outer edge of the heap of potting soil are spread over the crocks. The same end,



that of keeping the finer particles of the soil from mixing with the drainage crocks, may be attained by shaking in a little clean moss. A handful or two of the soil is then put in, and on this the plant with its roots spread out is to be set a trifle higher than the plant should stand in the pot when

finished off; more soil is to be added, and the whole pressed firmly with the fingers, the base of the stem being just below the pot rim, and the surface being smoothed off so as to slope a little outwards. When finished off, the pots should be well watered, to settle the soil; but they should stand till the water has well drained away, since, if they are moved about while the fresh soil is very wet, there will be a risk of its becoming puddled or too much consolidated. Larger plants do not need quite such delicate treatment, but care should be taken not to handle the roots roughly. The soil for these should be less comminuted, and the amount of drainage material more ample. Larger bodies of soil also require to be more thoroughly consolidated before watering; otherwise they would settle down so as to leave an unsightly void at the pot-rim.

Some plants, especially when potted temporarily, may be dealt with in a simpler way. A single crock may be used in some cases, and in others no crock at all, but a handful of half-decayed leaves or of littery dung thrown into the bottom of the pot. This mode of potting does well for bulbs, such as hyacinths, which are either thrown away or planted out when the bloom is over. The bedding plants generally may be potted in this way, the advantage being that at planting-out time there is less risk of disturbing the roots than if there were potsherds to remove. Plants of this character should be potted a little less firmly than specimens which are likely to stand long in the pot, and indeed the soil should be made comparatively light by the intermixture of leaf-mould or some equivalent, in order that the roots may run freely and quickly into it.

For epiphytal plants like orchids the most thorough drainage must be secured by the abundant use of potsherds,

small pots being sometimes inserted inside the larger ones, or by planting in shallow pots or pans, so that there shall be no large mass of soil to get consolidated. For most of these the lightest spongy but sweet turfy peat must be used, this being packed lightly about the roots, and built up above the pot-rim, or in some cases freely mixed before use with chopped sphagnum moss and nodules of broken pots or of charcoal. The plants under these conditions often require to be supported by wooden pegs or sticks. Some of the species grow better when altogether taken out of the soil and fixed to blocks of wood, but in this case they require a little coaxing with moss about the roots until they get established. In other cases they are planted in open baskets of wood or wire, using the porous peat and sphagnum compost. Both blocks and baskets are usually suspended from the roof of the house, hanging free and sloping, so that no accumulation of water is possible. In these cases, however, the greatest caution is necessary to prevent the plants suffering from drought.

When repotting is adopted as a temporary expedient, as in the case of bedding-out plants which it is required to push forward as much as possible, it will suffice if provision is made to prevent the drainage hole from getting blocked, and a rich light compost is provided for the encouragement of the roots. When, however, a hard-wooded plant has to be repotted, the case is different; it may stand without further potting for one year or two years or more, and therefore much more care is necessary. The old ball of earth must be freed from all or most of the old crocks without doing injury to the roots, and the sharp edge of the upper surface gently rubbed off. If there be any sour or sodden or effete soil into which the roots have not

run, this should be carefully picked out with a pointed stick. The ball is to be set on the new soil just high enough that when finished the base of the stem may be about level with the pot-rim, towards which the surface should slope gently, and the space between the old ball and the sides of the pot is to be filled in gradually with the prepared compost, which is from time to time to be pressed down with a blunt-ended flat piece of wood called a potting-stick, so as to render the new soil as solid as the old. The object of this is to prevent the plant from starving by the water applied all running off by way of the new soil, and not penetrating the original ball of earth. When this amount of pressure is necessary, especially in the case of loamy composts, the soil itself should be rather inclined to dryness, and should in no case be sufficiently moist to knead together into a pasty mass. In ordinary cases the potting soil should be just so far removed from dryness that when a handful is gently pressed it may hang together, but may lose its cohesion when dropped.

When plants are required to stand in ornamental china pots or vases, it is better both for the plants and for avoiding risk of breakage, to grow them in ordinary garden pots of a size that will drop into the more valuable vessels. Slate pots or tubs, usually square, are sometimes adopted, and are durable and otherwise unobjectionable, only, their sides being less porous, the earth does not dry so rapidly, and some modification of treatment as to watering is necessary. For large conservatory specimens wooden tubs, round or square, are frequently used; these should be coated with pitch inside to render them more durable.

Various other contrivances take the place of garden pots for special purposes. Thus shallow square or oblong

wooden boxes, made of light inexpensive wood, are very useful for seed-sowing, for pricking out seedlings, or for planting cuttings. When the disturbance of the roots incidental to all transplanting is sought to be avoided, the seed or plant is started in some cases in squares of turf (used grassy-side downwards), which can when ready be transferred to the place the plant is to occupy. Cucumber and melon plants and vines reared from eyes are sometimes started in this way, both for the reason above mentioned, and because it prevents the curling of the roots apt to take place in plants raised in pots. Strips of turf are sometimes used for the rearing of early peas, which are sown in a warmish frame, and gradually hardened so as to bear exposure before removal to the open air.

Watering.—The guiding principle in watering plants is to do it thoroughly when it is required, and to abstain from giving a second supply till the first has been taken up.

When watering becomes necessary for kitchen-garden crops, the hose should be laid on and the lines of esculents allowed to drink their fill, if fresh succulent vegetables are desired. So also, if well-swelled and luscious fruits, such as strawberries, are required, there must be no parching at the roots. This applies even more strongly to conservatory borders and to forcing-houses than to the outside fruit-tree borders, because from these the natural rain supply is in most cases more distinctly cut off. In the case of forcing-houses, the water should be heated to 80° before being applied to the borders which contain the roots of the trees.

In the watering of pot plants the utmost care is requisite if the plant be a shy-growing or valuable one, and yet it is almost impossible to give any intelligible instruction for

performing the operation. The roots should never be suffered either to get thoroughly dry or to get sodden with excess of water. An adept will know by the ring of the pot on striking it with his knuckles whether water is wanted or not, according as it rings loud and clear or dull and heavy. With very choice subjects watering may be necessary two or three times a day in drying summer weather. It is a wrong though common practice to press the surface of the soil in the pot in order to feel if it is moist enough, as this soon consolidates it, and prevents it from getting the full benefit of aëration.

In all heated houses the water used should be warmed at least up to the temperature of the atmosphere, so as to avoid chilling the roots. This is also necessary in the case of water used for syringing the plants, which should be done two or three times a day in all stoves and forcing-houses, especially during the period when the young growth is being developed. The damping of all absorbent surfaces, such as the floors or bare walls, &c., is frequently necessary several times a day in the growing season, so as to keep up a humid atmosphere; hence the advantage of laying the floors a little rounded, as then the water draws off to the sides against the kerbstone, while the centre remains dry for walking on.

In cooler structures it becomes necessary in the dull season of the year to prevent the slopping of water over the plants or on the floor, as this tends to cause "damping off,"—the stems assuming a state of mildewy decay, which not unfrequently, if it once attacks a plant, will destroy it piece by piece. To avoid this unpleasant result cleanliness and free ventilation are of great importance.

Pruning.—Pruning is a very important operation in

the fruit garden, its object being twofold,—(1) to give form to the tree, and (2) to induce the free production of flower-buds as the precursors of a plentiful crop of fruit. To form a standard tree, either the stock is allowed to grow up with a straight stem, by cutting away all side branches up to the height required, say about 6 feet, the scion or bud being worked at that point, and the head developed therefrom ; or the stock is worked close to the ground, and the young shoot obtained therefrom is allowed to grow up in the same way, being pruned in its progress to keep it single and straight, and the top being cut off when the desired height is reached, so as to cause the growth of lateral shoots. If these are three or four in number, and fairly balanced as to strength and position, little pruning will be required. The unripened tips of the wood should be cut back about one-third their length at an outwardly placed bud, and the chief pruning thereafter required will be to cut away inwardly directed shoots which cross or crowd each other and tend to confuse the centre of the tree. Bushy heads should be thinned out, and those that are irregular cut back so as to remodel them. If the shoots produced are not sufficient in number, or are badly placed, or very unequal in vigour, the head should be cut back moderately close, leaving a few inches only of the young shoots, which should be pruned back to buds so placed as to furnish shoots in the positions desired. When worked at the top of a stem formed of the stock, the growth from the graft or bud must be pruned in a similar way. Three or four leading shoots should be selected to pass ere long into boughs and form a well-balanced skeleton for the tree ; these boughs, however, will soon grow beyond any artificial system the pruner may adopt.

To form a dwarf or bush fruit tree the stock must be worked near the ground, and the young shoot produced from the scion or bud must be cut back to whatever height it is desired the dwarf stem should be, say $1\frac{1}{2}$ to 2 feet. The young shoots produced from the portion of the new wood retained are to form the skeleton of the bush, and must be dealt with as in the case of standards. The growth of

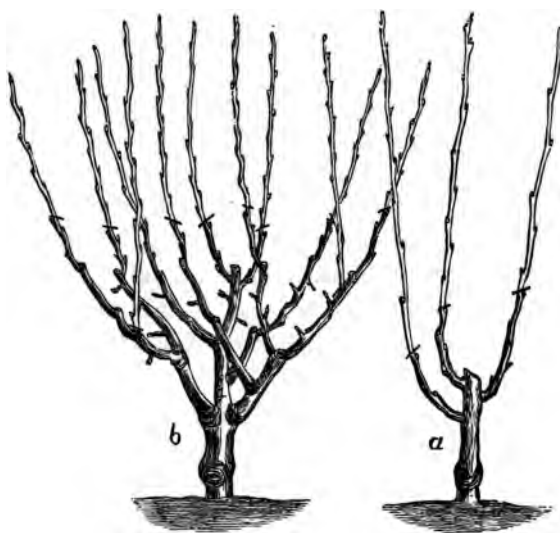


FIG. 66.—Dwarf-Tree Pruning.

inwardly-directed shoots is to be prevented, and the centre kept open, that the tree may assume a cup-shaped outline. Fig. 66, reduced from M. Hardy's excellent work, *Traité de la Taille des Arbres Fruitières*, will give a good idea how these dwarf trees are to be manipulated, *a* showing the first year's development from the maiden tree after being headed back, and *b* the form assumed a year or two later.

In forming a pyramidal tree, the lateral growths, instead

of being removed, as in the standard tree, are encouraged to the utmost ; and in order to strengthen them the upper

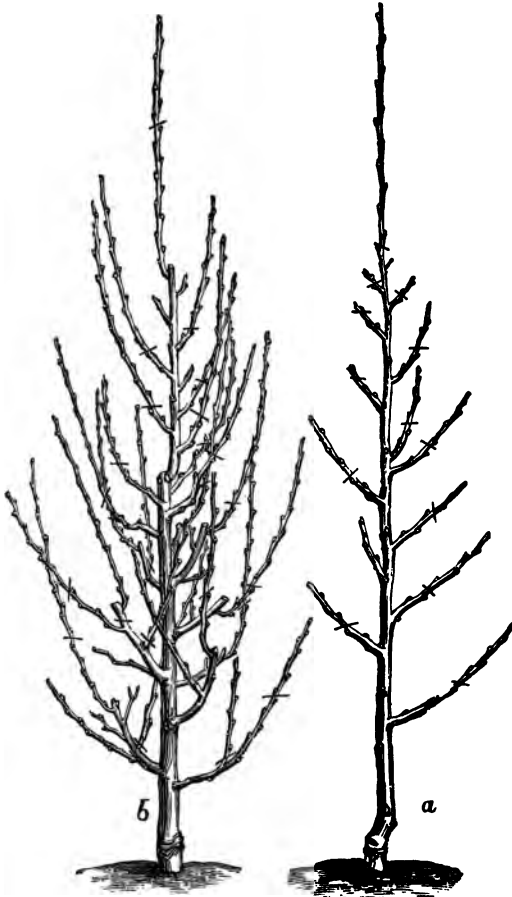


FIG. 67.—Pyramid Pruning.

part of the leading shoot is removed annually, the side branches being also shortened somewhat as the tree ad-

vances in size. In fig. 67, reduced from M. Hardy's work, *a* shows a young tree with its second year's growth, the upright shoot of the maiden tree having been moderately headed back, being left longer if the buds near the base promise to break freely, or cut shorter if they are weak and wanting in vigour. The winter pruning, carried out with the view to shape the tree into a well-grown pyramid, would be effected at the places marked by a cross line. The lowest branch would have four buds retained, the end one being on the lower side of the branch. The two next would be cut to three buds, which here also are fortunately so situated that the upper one is on the lower side of the branches. The fourth is not cut at all, its terminal bud being allowed to grow to draw strength into it. The fifth is an example where the bud to which the shoot should be cut back is wrongly placed; a shoot resulting from such a cut is apt instead of growing outwards to grow erect, and lead to confusion in the form of the tree, to avoid which it is tied down in its proper place during the summer by a small twig. The upper shoots are cut closer in. Near the base of the stem are two prominent buds, which would produce two vigorous shoots, but these would be too near the ground, and the buds should therefore be suppressed; but, to strengthen the lower part, the weaker buds just above and below the lowest branch should be forced into growth, by making a transverse incision close above each. Fig. 67, *b* shows what a similar tree would be at the end of the third year's growth.

In order to bring a young tree into the cordon shape, all its side branches are shortened back, either to form permanent spurs, as in the case of pears, or to yield annual young shoots, as in peaches and nectarines. The single-stemmed

cordon may be trained horizontally, obliquely at any required angle, or vertically if required, the first two arrangements being preferable. If a double cordon is required, the original young stem must be headed back, and the two best shoots produced must be selected, trained right and left, and treated as for the single cordon.

The forms chiefly adopted for trees trained to walls and espalier rails are the fan-shaped, the half-fan, and the horizontal, with their various modifications.

Of late years the close pruning of the young trees has been objected to, and the "extension system" has, in many cases, been adopted. The maiden tree is headed down, and two shoots led away right and left. Two laterals should be allowed to grow from the upper side of them, one from near the base, the other from near the middle, all others being pinched out beyond the second or third leaf during summer, but cut away to the last bud in winter. The tree will thus consist of six shoots, probably 3 feet to 4 feet long, which are not to be pruned unless they are unequal in strength, a defect which is rather to be remedied by summer pinching than by winter pruning. The second year three young shoots are to be left on each of the six, one close to the base, one about the middle, and one at the point, the rest being rubbed off. These three shoots will produce laterals, of which one or two may be selected and laid in; and thus a number of moderately strong fertile shoots will be obtained, and at the end of the season a comparatively large tree will be the result.

The method of pruning ordinarily adopted for the formation of a fan-shaped tree is to head down the maiden plant to about two eyes, so placed as to yield a young shoot on each side (fig. 68), the supernumerary shoots

being rubbed off while quite young, and the reserved shoots trained against the wall during the summer so as to get them well matured. The next year they are cut back again, often nearly to the base, in order that the lower pair of these shoots may each produce two well-placed young shoots, and the upper pair three young shoots. The tree would thus consist of ten shoots, to be laid out at regular distances, and then if closely cut the skeleton of the tree would be as in fig. 69. These main shoots are not again to be shortened back, but from each of them three young shoots are to be selected and trained in, two



FIG. 68.—Pruning for Fan-Shaped Tree.

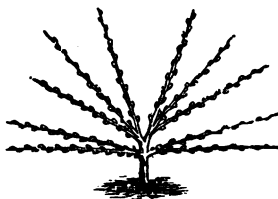


FIG. 69.—The same —third year.

on the upper side, one near the base, and the other half-way up, and one on the lower side placed about midway between these two; these with the leading shoot, which is also to be nailed in, make four branches of the current year from each of the ten main branches, and the form of the tree would therefore be that of fig. 70. The other young shoots produced are pinched off while quite young, to throw all the strength of the tree into those which are to form its basis, and to secure abundant light and air. In after years the leading shoot is not to be cut back, but all the lateral shoots are to be shortened, and from these year by year other shoots are to be selected to fill up the area occupied by the tree

In pruning for a horizontal tree the young maiden tree has to be headed back nearly to its base, and from the young shoots three are to be selected, the two best placed lower ones to form an opposite or nearly opposite pair of

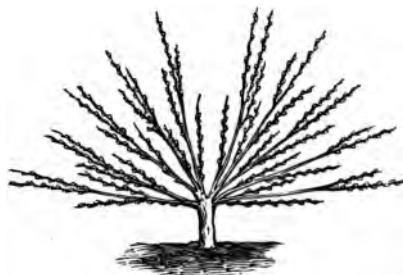


FIG. 70.—The same—fourth year.

main branches, and the best placed upper one to continue the erect stem (fig. 71). This upper shoot is at the next winter pruning to be cut down to within about a foot of the point whence it sprung, and its buds rubbed off except the



FIG. 71.—Pruning for Horizontally-Trained Tree.



FIG. 72.—The same —third year.

upper one for a leader, and one on each side just below it to furnish another pair of side shoots ; these being trained in position, the tree would appear as in fig. 72. The same course is to be followed annually till the space is filled. Sometimes in very favourable soils and with vigorous trees two pairs of branches may be obtained in one season by summer-stopping the erect shoots and selecting others from

the young growths thus induced, but more commonly the trees have to be built up by forming one pair of branches annually. The shoots are not at first lowered to the horizontal line, but are brought down gradually; and while the tree is being formed weak shoots may be allowed to grow in a more erect position than it is ultimately intended they should occupy. Thus in four or five years the tree will have acquired something the character of fig. 73, and will go on thus increasing until the space is filled.

The half-fan is a combination of the two forms, but as re-

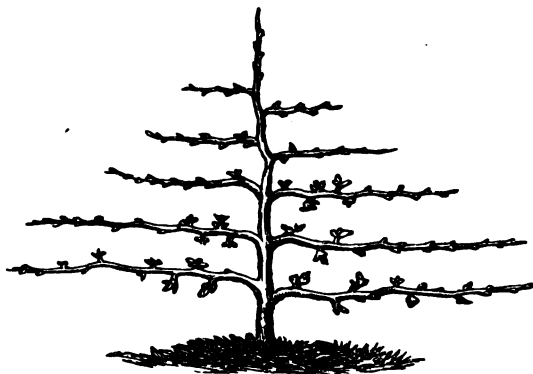


FIG. 73.—The same—fifth year.

gards pruning does not materially differ from the horizontal, as two opposite side branches are produced in succession upwards till the space is filled, only they are not taken out so abruptly, but are allowed to rise at an acute angle and then to curve into the horizontal line.

In all the various forms of cordons, in horizontal training, and in fan and half-fan training, the pruning of the main branches, when the form of the tree is worked out, will vary in accordance with the kind of fruit under treatment. Thus

in the peach, nectarine, apricot, plum, and cherry, which are commonly trained fan-fashion, the first two will have to be pruned so as to keep a succession of young annual shoots, these being their fruit-bearing wood. The others are generally pruned so as to combine a moderate supply of young wood with a greater or less number of fruit spurs. In the pear and apple the fruit is borne principally on spurs, and hence what is known as spur-pruning has to be adopted, the young shoots being all cut back nearly to their base, so as to cause fruit buds to evolve from the remaining eyes or buds. Cordons of apples and pears have to be similarly treated, but cordons of peaches and nectarines are

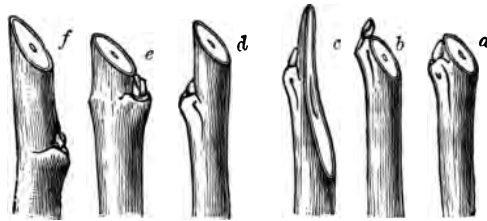


FIG. 74.—Cuts—Good and Bad.

pruned so as to provide the necessary annual succession of young bearing wood.

The nature of the cut itself in pruning is of more consequence, especially in the case of fruit trees, than at first sight may appear. The branches should be separated by a clean cut at an angle of about 45° , just at the back of a bud, the cut entering on a level with the base of the bud and passing out on a level with its top (fig. 74, *a*), for when cut in this way the wound becomes rapidly covered with new wood, as soon as growth recommences, whereas if the cut is too close the bud is starved, or if less close an ugly

and awkward snag is left. Fig. 74, *b* and *c*, are examples of the former, and *d*, *e*, *f* of the latter. Dr Lindley has designated the cut shown at fig. 74, *b* the cut to the quick (*Gardeners' Chronicle*, 1847, p. 19):—

“In order to avoid the risk of the ‘cut to the quick,’ some gardeners make use of the ‘snag cut’ (*d*, *e*, *f*), in which the wound is made on the same side of the branch as that occupied by the bud, slanting downwards towards it. That plan is objectionable; for it involves the necessity of leaving behind a dead portion of the branch, to be removed at a later pruning, so the work must be done twice over; moreover, it is an admission of a want of the skill required to make the ‘clean cut’ skilfully. Lastly, there is the ‘slivering cut’ (*c*), in which a long ragged unequal shave is taken off the branch, much too low in the beginning, and much too high at the end. It is the cut made by garden labourers. It is clumsy, ugly, awkward, and dangerous, for it is apt to injure the branch on which it is made. In all cases, the amputation should be made by one firm-drawn cut. The clean cut can be performed by a dexterous operator to within a shaving of the right line; and the mastery of this art is no mean acquisition.”

In the case of fruit trees, and indeed of deciduous plants generally, pruning requires to be done during the winter or resting period, and the earlier in that period the better, as then the buds become plump and full of sap, and produce strong shoots when the time for growth arrives. If, on the contrary, it is done while the plant is in full growth, the whole system of the tree sustains a check, the circulation is deranged, the quality of the sap becomes deteriorated, and a dead stump or unhealthy shoot is the frequent result. This, however, does not apply to the pruning of the herbaceous or succulent growths of the current season, nor to soft-wooded plants generally, for this kind of pruning, called summer pruning, is essential to the formation of handsome specimens of the latter, and is a very important help in the formation of the fruit or blossoms of fruit trees.

Summer Pruning should be performed while the shoots are yet young and succulent, so that they may in most cases be nipped off with the thumb-nail. It is very necessary in the case of trees trained to a flat surface, as a wall or espalier rail, to prevent undue crowding. In some cases, as, for example, with peaches, the superfluous shoots are wholly removed, and certain selected shoots reserved to supply bearing wood for next year. In others, as pears, the tops of the young shoots are removed, leaving three or four leaves and their buds at the base, to be developed into fruit buds by the additional nourishment thus thrown into them (fig. 75, *a*). One or two may



FIG. 75.—Summer Pruning for Spurs.

push out a later growth (fig. 75, *b*) ; this will serve as a vent for the vigour of the tree, and if the lowermost only go to the formation of a fruit spur, the object will have been gained. They are cut to the last dormant bud in winter.

But summer pruning has been much extended since the introduction of restricted growth and the use of dwarfing stocks. Orchard-house trees, and also pyramidal and bush trees of apples, pears, and plums, are mainly fashioned by summer pruning ; in fact, the less the knife is used upon them, except in the necessary cutting of the roots in potted

trees, the better. In the case of orchard-house plants no shoots are suffered to lengthen out, except as occasionally wanted to fill up a gap in the outline of the tree. On the contrary, the tops of all young shoots are pinched off when some three or four leaves are formed, and this is done again and again throughout the season. When this pruning is just brought to balance with the vigour of the roots, the consequence is that fruit buds are formed all over the tree, instead of a thicket of sterile and useless wood. Pyramidal and bush trees out of doors are, of course, suffered to become somewhat larger, and sufficient wood must be allowed to grow to give them the form desired; but after the first year or two, when the framework is laid out, they are permitted to extend very slowly, and never to any great extent, while the young growths are continually nipped off, so as to clothe the branches with fruit buds as closely placed as will permit of their healthy development.¹

The *Pruning of Flowering Plants* is generally a much lighter matter than the pruning of fruit trees. If a young seedling or cutting of any soft-wooded plant is to be bushy, it must have its top nipped out by the thumb-nail or pruning-scissors at a very early stage, and this stopping must be repeated frequently. If what is called a well-furnished plant is required, an average of from 2 to 3 inches is all the extension that must be permitted—sometimes scarcely so much—before the top is nipped out; and this must be continued until the desired size is attained, whether that be large or small. Then

¹ On the general subject of pruning fruit trees the reader may usefully consult Thompson's *Gardener's Assistant*, Bréhaut's *Modern Peach Pruner*, Forney's *Jardinier Fruitier*, Hardy's *Traité de la Taille des Arbres Fruitières*, and Dubreuil's *Culture des Arbres et Arbrisseaux à Fruits de Table*.

generally the plant is allowed to grow away till bloom or blooming shoots are developed. To form a pyramidal plant, which is a very elegant and useful shape to give to a decorative pot plant, the main stem should be encouraged to grow upright, for a length perhaps of 6 or 8 inches before it is topped; this induces the formation of laterals, and favours their development. The best-placed upper young shoot is selected and trained upright to a slender stake, and this also is topped when it has advanced 6 or 8 inches further, in order to induce the laterals on the second portion to push freely. This process is continued till the required size is gained. With all the difficult and slow-growing plants of the hard-wooded section, all the pruning must be done in this gradual way in the young wood as the plant progresses.

Some plants, like pelargoniums, can only be kept handsomely formed and well furnished by cutting them down severely every season, after the blooming is over. The plants should be prepared for this by keeping them rather dry at the root, and after cutting they must stand with little or no water till the stems heal over, and produce young shoots, or "break," as it is technically termed. The appearance of a specimen pelargonium properly pruned is shown in fig. 76, in which *a* shows a young plant, the head of which has been taken off to form a cutting, and whose buds are ready to break into young shoots. Three shoots will be produced, and these, after growing from 4 to 6 inches in length, should be stopped by pinching out the point, this giving rise to lateral shoots. These will blossom in due course, and, after being ripened thoroughly by full exposure to the sun, should be cut back as shown at *b*. This is the proper foundation for a good specimen, and

illustrates how all such subjects should be pruned to keep them stocky and presentable in form.

Root Pruning is most commonly practised in fruit tree cultivation. It is often resorted to as a means of restoring fertility in plants which have become over rank and sterile in growth. The effect of it, or of transplanting, is to reduce the supply of crude sap to the branches, and consequently to cause a check in their development. In root-pruning all roots that have struck downwards into a cold uncongenial subsoil must be pruned off if they cannot be turned in a lateral direction, and all the lateral ones that

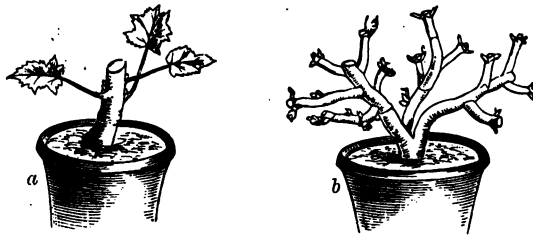


Fig. 76.

have become coarse and fibreless must also be shortened back by means of a clean cut with a sharp knife, while some hard rubbly material may if necessary be put under the tree before it is again planted, all its roots being laid out laterally, radiating as equally as possible from the centre. The operation is best performed early in autumn, and may be safely resorted to in the case of fruit trees of moderate age, and even of old trees if due care be exercised. In transplanting trees all the roots which may have become bruised or broken in the process of lifting should be cut clean away behind the broken part, as they then more readily strike out new roots from the cut parts. In all

these cases the cut should be a clean sloping one, and made in an upward and outward direction.

The root-pruning of pot-plants is necessary in the case of many soft-wooded subjects which are grown on year after year—pelargoniums and fuchsias, for example. After the close pruning of the branches to which they are annually subjected, and when the young shoots have shot forth an inch or two in length, they are turned out of their pots and have the old soil shaken away from their roots, the longest of which, to the extent of about half the existing quantity, are then cut clean away, and the plants repotted into small pots. This permits the growing plant to be fed with rich fresh soil, without having been necessarily transferred to pots of unwieldy size by the time the flowering stage is reached.

Ringing.—One of the expedients for inducing a state of fruitfulness in trees, is the ringing of the branches or stem, that is, removing a narrow annular portion of the bark, by which means, it is said, the trees are not only rendered productive, but the quality of the fruit is at the same time improved. The advantage depends on the obstruction given to the descent of the sap. The ring should be cut out in spring, and be of such a width that the bark may remain separated for the season. A tight ligature of twine or wire answers the same end. The advantages of the operation may perhaps be gained by judicious root pruning, and it is not at all adapted for the various stone fruits.

Training.—What is called training is the guiding of the branches of a tree or plant in certain positions which they would not naturally assume, the object being partly to secure their full exposure to light, and partly to regulate the flow and distribution of the sap. To secure the for-

mer object, the branches must be so fixed as to shade each other as little as possible; and to realize the second, the branches must have given to them an upward or downward direction, as they may require to be encouraged or repressed. Something of the same vegetative vigour which is given to a plant or tree by hard pruning is afforded by training in an upward direction so as to promote the flow of the sap; while the repression effected by summer pruning is supplemented by downward training, which acts as a check. One main object is the preservation of equilibrium in the growth of the several parts of the tree; and for this various minor details deserve attention. Thus a shoot will grow more vigorously whilst waving in the air than when nailed close to the wall; consequently a weak shoot should be left free, whilst its stronger antagonist should be restrained; and a luxuriant shoot may be retarded for some time by having its tender extremity pinched off to allow a weaker shoot to overtake it.

Mr Robert Thompson, who is to be regarded as an authority, says (*Gardener's Assistant*, 340):—

“A fair exposure to light is one of the principal objects to be borne in mind in training; but the branches may be well regulated as regards exposure to light, without being equally so with respect to the flow of sap. For instance, they may be disposed like the radii of a circle touching the circumference at equal distances (fig. 77, *aa*, *bb* *cc*, *v*). We shall, however, suppose that the central vertical shoot *v* has been cut back nearly to its base in order to furnish from buds there situated the rudiments of other branches. The sap flows with much greater force into the upright or nearly upright branches than it does into those having a horizontal position; therefore branches radiating at equal distances, like those in the figure, would soon become very unequal in point of vigour; *cc* would of course be strong, *aa* comparatively weak, whilst *bb* would maintain a somewhat intermediate condition. If, instead of training the shoots *cc* in a straight direction, we depress them at *dd* and

bend them in the growing season as indicated by the curved line towards *bb*, we shall greatly check their over-luxuriance. On the other hand, by elevating the horizontal shoots at *ee*, and training them in the direction of the dotted line towards *bb*, those shoots will be thereby greatly invigorated. In short, by curving the upper branches downwards and the lower ones upwards, the flow of sap is checked in the former and promoted in the latter ; and the consequence is that *aa* and *cc* are equal to the medium *bb* and to each other."

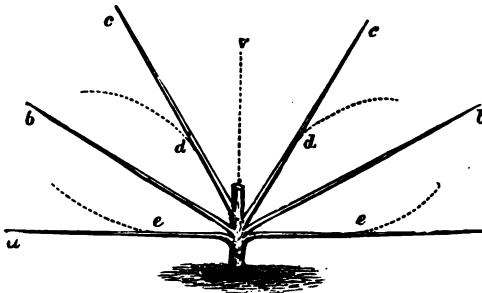


FIG. 77.—Diagram illustrating Branch Distribution.

By these and other expedients, and by the prudent use of the knife, fruit trees may be readily trained into the forms indicated below, which are amongst the best out of the many which have been devised.

The training of standard and bush trees in the open ground has been already referred to under the section *Pruning*. When the growth of pyramids is completed, the outline is something like that of fig. 78, and very pretty trees are thus formed. It is better, however, especially if the tendency to bear fruit is rather slack, to adopt what the French call *en quenouille* training (fig. 79), which consists in tying or weighting the tips of the branches so as to give them all a downward curve. Pear trees worked on the quince stock, and trained *en quenouille*, are generally very fertile.

Wall trees, it must be evident, are placed in a very unnatural and constrained position, and would in fact soon



FIG. 78.—Pyramidal Training.

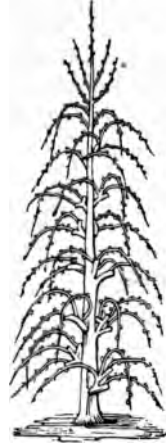


FIG. 79.—Training *en guenouille*.

be reduced to a state of utter confusion, if allowed to grow unrestricted ; hence the following modes of training have been adopted.

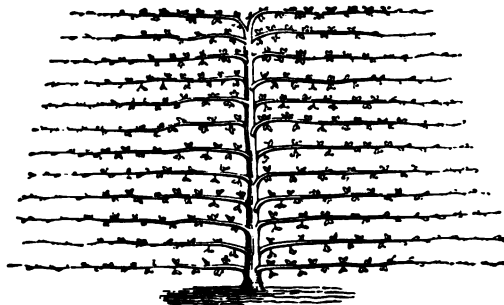


FIG. 80.—Horizontal Training.

Horizontal Training (fig. 80) has long been a favourite

form in England. There is one principal ascending stem, from which the branches depart at right angles, at intervals of about a foot. Horizontal training is best adapted to the apple and the pear; and for the more twiggy growing slender varieties, the forms shown in fig. 81 have been recommended. In these the horizontal branches are placed wider, 18 to 20 inches apart, and the smaller shoots are trained between them, either on both sides, as at *a*, or deflexed from the lower side, as at *b*. The latter is an

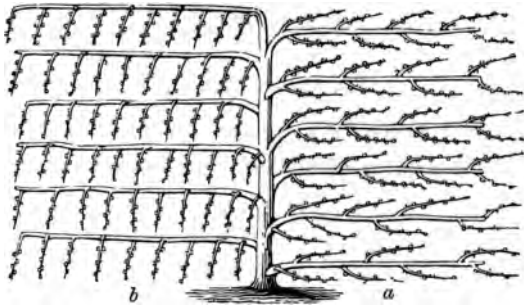


FIG. 81.—Forms of Horizontal Training.

excellent method of reclaiming neglected trees. Every alternate branch should be taken away, and the spurs cut off, after which the young shoots are trained in, and soon produce good fruit.

In *Fan Training* (fig. 82) there is no leading stem, but the branches spring from the base and are arranged somewhat like the spokes of a fan. This mode of training is commonly adopted for the peach, nectarine, apricot, and Morello cherry, to which it is best adapted. Though sometimes adopted, it is not so well suited as the horizontal form for apples and pears, because, when the branches reach the top of the wall, where they must be cut short, a *tête de*

saule, or hedge of young shoots, is inevitable. A modification of the fan shape (fig. 83) is sometimes adopted for

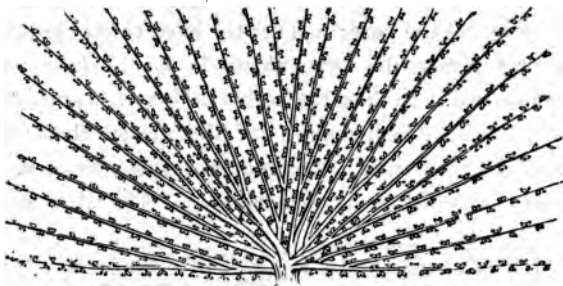


FIG. 82.—Fan Training.

stone fruits, such as the apricot. In this the object is to establish a number of mother branches, and on these to

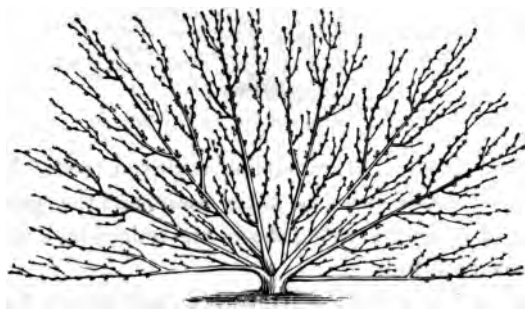


FIG. 83.—Modified Fan Training.

form a series of subordinate members, chiefly composed of bearing wood. The mother branches or limbs should not be numerous, but well-marked, equal in strength, and regularly disposed. The side branches should be pretty abundant, short, and not so vigorous as to rival the leading members.

The *Half-fan* mode of training, which is intermediate between horizontal and fan training, is most nearly allied to the former, but the branches leave the stem at an acute angle, a disposition supposed to favour the more equal distribution of the sap. Sometimes, as in fig. 84, two vertical stems are adopted, but there is no particular advantage in this, and a single-stemmed tree is more manageable. The half-fan form is well adapted for such fruits as the plum and the cherry; and, indeed, for fruits of

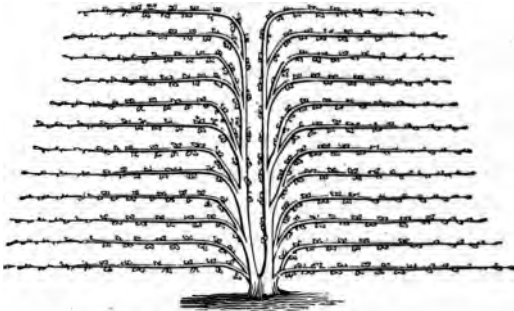


FIG. 84.—Half-Fan Training.

vigorous habit, it seems to combine the advantages of both the foregoing.

Trees must be fixed to the walls and buildings against which they are trained by means of nails and shreds, or in cases where it is desired to preserve the wall surface intact, by permanent nails or studs driven in in regular order. Sometimes the walls are furnished with galvanized wires, but this has been objected to as causing cankering of the shoots, for which, however, painting is recommended as a remedy, and which is also avoided, it is said, by crossing the tying material between the wire and the wood, and so preventing them from coming in contact. If they are

adopted, the wires should be close to the wall to prevent a cold draught between it and the tree. Care should be taken that the ties or fastenings do not eventually cut into the bark as the branches swell with increased age. When shreds and nails are used, cast wall nails and "medicated shreds" are the best; the nails should be of small size for the young shoots.

For tying plants to trellises and stakes nothing is better than soft tarred string. Osier ties are sometimes used for espaliers. The training in of summer shoots on wall-trees is often done by means of slender twigs; indeed the prunings of the trees themselves, stripped of their leaves, often serve the purpose very well; the two ends are tucked under the adjacent fixed shoots, and embrace the young shoots to be fastened in, which are thus held close to the wall. Crooked shoots should be straightened at the principal or winter training; this is done by pulling the convex side towards the straight line desired by means of the tie or shred, the next above and below being set so as to pull in the opposite direction.

In training greenhouse plants the young branches should be drawn outwards by means of ties fastened to a string or wire under the pot-rim; the centre then fills up, and slender stakes are used as required; but the fewer these are in number the better. Climbers are trained from the bottom around or across trellises, of which the cylindrical or the balloon-shaped, or sometimes the flat oval or circular, are the best forms. The size should be adapted to the habit of the plant, which should cover the whole by the time flowers are produced. Bast fibre and raphia fibre are to be preferred for light subjects of this character, as they can be split to any degree of fineness; but the

latter is not durable enough or strong enough for coarse-growing border flowers. Very durable trellises for greenhouse climbers are made of slender round iron rods for standards, having a series of hooks on the inner edge, into which rings of similar metal are dropped ; the rings



FIG. 85.—Clematis trained on Balloon-shaped Trellis.

may be graduated so as to form a broad open top, or may be all of the same size, when the trellis will assume the cylindrical form. Fig. 85 shows a pot specimen of clematis trained over a balloon-shaped trellis.

The training of bedding plants over the surface of the

soil is done by small pegs of birch wood or bracken, by loops of wire, or sometimes by loops of bast having the ends fixed in the soil by the aid of the dibble. The object is to fill up the blank space as quickly and as evenly as possible.

Forcing.—This is the accelerating, by special treatment, of the growth of certain plants, which are required to be had in leaf, in flower, or in fruit before their natural season,—as, for instance, the leaves of mint at Eastertide or the leafstalks of sea-kale and rhubarb at Christmas, the flowers of summer in the depth of winter, or some of the choicest fruits perfected so much before their normal period as to complete, with the retarded crops of winter, the circle of the seasons.

In the management of artificial heat for this purpose, a considerable degree of caution is required. The first stages of forcing should, of course, be very gentle, so that the whole growth of the plants may advance in harmony. A very hot atmosphere would unduly force the tops, while the roots remained partially or wholly inactive; and a strong bottom heat, if it did not cause injury by its excess, would probably result in abortive growth.

Any sudden decrease of warmth would be very prejudicial to the progress of vegetation through the successive stages of foliation, inflorescence, and fructification. But it is not necessary that one unvarying range of temperature should be kept up at whatever pains or risk. Indeed, in very severe weather it is found better to drop a little from the maximum temperature by fire heat, and the loss so occasioned may be made good by a little extra heat applied when the weather is more genial. Night temperatures also should always be allowed to drop somewhat, the heat being

increased again in the morning. In other words, the artificial temperature should increase by day and decrease by night, should rise in summer and fall in winter, should, in short, imitate as nearly as possible the varying influence of the sun.

For the growth of flowers generally, and for that of all fruits, every ray of light to be obtained in the dull winter season is required, and therefore every possible care should be taken to keep the glass clean. A moist genial atmosphere too is essential, a point requiring unremitting attention on account of the necessity of keeping up strong fires. With moisture as with heat, the cultivator must hold his hand somewhat in very severe or very dull weather ; but while heat must not drop so as to chill the progressing vegetation, so neither must the lack of moisture parch the plants so much as to check their growth.

There are some few subjects which when forced do not require a light house. Thus amongst flowers the white blossoms of the lilac, so much prized during winter, are produced by forcing the plant in darkness. Rhubarb and sea-kale among esculents both need to be forced in darkness to keep them crisp and tender, and mushrooms also are always grown in dark structures. In fact, a roomy mushroom house is one of the most convenient of all places for forcing the vegetables just referred to. The lilac would be better placed in a dark shed heated to about 60°, in which some dung and leaves could be allowed to lie and ferment, giving off both a genial heat and moisture.

One of the most important preliminaries to successful forcing is the securing to the plants a previous state of rest. The thorough ripening of the preceding season's wood in fruit trees and flowering plants, and of the crown in peren-

nial herbs like strawberries, and the cessation of all active growth before the time they are to start into new growth, are of paramount importance. The ripening process must be brought about by free exposure to light, and by the application of a little extra heat with dryness, if the season should be unfavourable; and both roots and tops must submit to a limitation of their water supply. When the ripening is perfected, the resting process must be aided by keeping the temperature in which they await the forcing process as low as each particular subject can bear.

CHAPTER VI.

FLOWERS.



WHENEVER there is a flower garden of considerable magnitude, and in a separate situation, it should be constructed on principles of its own. The great object must be to exhibit to advantage the graceful forms and glorious hues of flowering plants and shrubs. Two varieties of flower gardens have chiefly prevailed in Britain. In one the ground is turf, out of which flower-beds, of varied patterns, are cut; in the other the flower-beds are separated by gravel walks, without the introduction of grass. When the flower garden is to be seen from the windows, or any other elevated point of view, the former is to be preferred; but where the surface is irregular, and the situation more remote, and especially where the beauty of flowers is mainly looked to, the choice should probably fall on the latter.

The situation of the flower garden must be influenced by the nature of the lawns, and of the site of the mansion to which it is attached. Generally speaking, it should not be at any great distance from the house; and in places where there is no distant view of importance, it may be constructed under the windows. On the other hand, when the park is spacious, and the prospects extensive and picturesque, it is perhaps better that the flower garden

should be at a little distance from and out of sight of the house, but easy of access in any sort of weather. In most cases, even when it is in the vicinity of the mansion, the flower garden should for security against ground game and other intruders be encircled with some sort of fence. In detached localities the fences may be made sufficiently strong to prevent the intrusion of every species of vagrant; since it is not difficult to mask them with shrubs and trees. The style of the mansion should determine that of the flower garden, and also its position. The flower garden attached to an elaborate mansion, should, for the most part, occupy the lawn on the south, the east, or the west front; and the carriage-entrance, where possible, should be on the north front, the park extending nearly or quite up to the front door. This arrangement must, however, sometimes be departed from in consequence of the difficulties of providing a proper approach to the entrance-door, and must also be regulated by the position of the principal rooms, which should if possible command a view of the flower garden.

When the garden is upon a large scale, and especially where a natural inclination in the ground exists, or can be formed artificially, terraces and parapet walls should be introduced, with flights of steps, and embellishments in connexion with them, such as fountains, statuary, sculpture, &c. Grass terraces alone have a mean appearance in such a position. The parapet walls afford excellent accommodation for half-hardy and beautiful flowering plants.

With regard to flower-plots, when the figures are separated by turf, it is necessary that the little lawns or glades should have a certain degree of breadth, as nothing has a worse effect than overcrowding. A multitude of little figures should also be avoided, as they produce the disagreeable

effect well named by Gilpin "spottiness." In this sort of flower garden it is desirable that a gravel walk should skirt at least one side of the principal figures, for in the humid climate of Britain the grass would otherwise render them inaccessible with comfort during a great part of the year. In those gardens where turf is wholly or partly excluded, the compartments should be of a larger and more massive character. Narrow borders, bounded by parallel straight lines and concentric curves, should be avoided. The centres of the figures should be filled with tall-growing shrubs, and even with an occasional low evergreen tree, such as a yew or a holly.

The walks, arranged in long easy curves, should communicate here and there with one another. A dial, a few seats, or an arbour, with an urn or two or a vase, may often be introduced with good effect.

The flower garden may include several different compartments. Thus, there is the "Rock Garden," which should consist of variously grouped masses of stone, those figured by water-wearing, or containing petrifications or impressions, or showing something of natural stratification, being generally preferred. In the cavities between the stones, filled with earth, alpine or trailing plants are inserted, and also some of the choicest flowers. In proper situations, a small pool of water may be introduced for the culture of aquatic plants. In a suitable position one of the walks may be arched over with wire-work, and covered with ornamental climbing shrubs, to form a delightful promenade in the glowing days of summer. A separate compartment laid out on some regular plan is often set apart for roses, under the name of the "Rosery." A moist or rather a shady border, or a section of the pleasure ground supplied

with bog earth, may be devoted to what is called the "American Garden," which, as it includes the gorgeous rhododendrons and azaleas, forms one of the grandest features of the establishment during the early summer, while if properly selected the plants are effective as a garden of evergreens at all seasons. The number of variegated and various-coloured hardy shrubs is now so great that a most pleasant plot for a "Winter Garden" may be arranged with plants of this class, with which may be associated hardy subjects which flower during that season or very early spring, as the Christmas rose, and amongst bulbs the crocus and snowdrop. Later on, the "Spring Garden" department is a scene of great attraction; and some of the gardens of this character, as those of Cliveden and Belvoir, are among the most fascinating examples of horticultural art.

Lawns.—In the formation of lawns the ground must be regularly broken up so that it may settle down evenly, any deep excavations that may have to be filled in being very carefully rammed down to prevent subsequent settlement. The ground must also be thoroughly cleared of the roots of all coarse perennial weeds, and be worked to a fine tilth ready for turving or sowing. The more expeditious method is of course to lay down turf, which should be free from weeds, and is cut usually in strips of 1 foot wide, 3 feet long, and about an inch in thickness.



FIG. 86.—Turf-Beater.

This must be laid very evenly and compactly, and should then be beaten down firmly with the implement called a turf-beater (fig. 86). When there is a large space to cover, it is much the cheaper plan to sow the lawn with grass-seeds, and equally effective, though the sward takes longer to thicken. It is of the utmost importance that a good selection of grasses be made, and that pure seeds should be obtained. The following sorts can be recommended, the quantities given being those for sowing an acre of ground :—

<i>Cynosurus cristatus</i> —Crested Dog's-tail.....	6 lb
<i>Festuca duriuscula</i> —Hard Fescue	3 lb
<i>Festuca ovina</i> —Sheep's Fescue.....	3 lb
<i>Lolium perenne tenue</i>	18 lb
<i>Poa nemoralis sempervirens</i> —Evergreen Meadow-grass....	3 lb
<i>Poa trivialis</i> —Trivial Meadow-grass.....	3 lb
<i>Trisetum flavescens</i> —Yellow Oat-grass.....	2 lb
<i>Trifolium repens</i> —Dutch Clover.....	6 lb

The seeds should be thoroughly mixed, and very evenly sown, after which the surface should be raked over to bury them, and then rolled down while dry so as to finish it off smooth and level. When thus sown, lawns require to be promptly weeded. During the growing season established lawns should be mown at least once a week. They should be occasionally rolled, and towards autumn they require frequent sweepings to remove worm-casts.

HARDY ANNUALS.

Annual plants are those which grow up from seed, flower, ripen seed, and die in the course of one season—one year. They are useful in the mixed garden, for though in some cases they are of short duration, many of them are possessed of much beauty of hue and elegance of form. Annuals may be divided into three classes :—the *hardy*, which are sown at once in the ground they are to occupy; the *half-hardy*, which succeed best when aided at

first by a slight hot bed, and then transplanted into the open air; and the *tender*, which are kept in pots, and treated as greenhouse or stove plants, to which departments they properly belong. Some of the more popular annuals, hardy and half-hardy, have been very much varied as regards habit and the colour of the flowers, and purchases may be made in the seed shops of such things as China asters, stocks, Chinese and Indian pinks, larkspurs, phloxes, and others, amongst which some of the most beautiful of the summer flowers may be found.

The hardy annuals may be sown in the open ground during the latter part of March or beginning of April, as the season may determine, for the weather should be dry and open, and the soil in a free-working condition before sowing is attempted. In favourable situations and seasons some of the very hardiest, as *Silene pendula*, *Saponaria*, *Nemophila*, *Gilia*, &c., may be sown in September or October, and transplanted to the beds or borders for very early spring flowering. Those sown in spring begin to flower about June. The patches, if left to flower where they are sown, should be thinned out while young, to give them space for proper development. It is from having ample room that pricked out transplanted seedlings often make the finest plants. The soil should be rich and light.

The half-hardy series are best sown in pots or pans under glass in mild heat, in order to accelerate germination. Those of them which are in danger of becoming leggy should be speedily removed to a cooler frame and placed near the glass, the young plants being pricked off into fresh soil, in other pots or pans or boxes, as may seem best in each case. All the plants must be hardened off gradually during the month of April, and may generally be planted out some time in May, earlier or later according to the season.

The class of tender annuals, being chiefly grown for greenhouse decoration, should be treated much the same as soft-wooded plants, being sown in spring, and grown on rapidly in brisk heat, near the glass, and finally hardened off to stand in the greenhouse when in flower.

We add a select list of some of the more distinct annuals desirable for general cultivation as decorative plants, and shall then mention a few of the most popular kinds separately:—

Acroclitum roseum : half-hardy, 1 ft., rose-pink or white ; everlasting.

Agrostis pulchella : hardy, 6 in. ; a most graceful grass for bouquets.

Amberboa moschata atropurpurea (Sweet Sultan) : hardy, 1½ ft., purple ; musk-scented.

Bartonia aurea : hardy, 2 ft., golden yellow ; showy and free.

Brachycome iberidifolia (fig. 87): half-hardy, 1 ft., blue or white with dark disk. This is also called the Swan-river Daisy.

Calendula officinalis Meteor: hardy, 1 ft., orange striped with yellow.

Calliopsis bicolor (tinctoria): hardy, 2 to 3 ft., yellow and chestnut-brown.

Calliopsis Drummondii: hardy, 1 to 2 ft., golden yellow with red disk.

Campanula Loreyi: hardy, 1½ ft., purplish-lilac or white; bell-shaped.

Centaurea Cyanus: hardy, 3 ft., blue, purple, pink, or white; showy.

Clarkia pulchella: hardy, 1½ ft., rosy-purple; some varieties very handsome.

Collinsia bicolor: hardy, 1½ ft., white and purple; pretty.

Collinsia verna: hardy, 1 ft., white and azure; sow as soon as ripe.



FIG. 87.—*Brachycome iberidifolia*.

Convolvulus tricolor atrovioleaceus: hardy, 1 ft., white, blue, and yellow. This is the *Convolvulus minor* of gardens.

Erysimum Peroffskianum: hardy, 2 ft., deep orange; in erect racemes.

Eschscholtzia californica: hardy, 1½ ft., yellow with saffron eye.

Eschscholtzia crocea flore-pleno: hardy, 1½ ft., orange yellow; double

Eutoca viscida: hardy, 2 ft., bright blue with white hairy centre.

Gaillardia Drummondii (picta): half-hardy, 1½ ft., crimson, yellow margin.

Gilia achilleaefolia: hardy, 2 ft., deep blue; in large globose heads.

Godetia Lindleyana: hardy, 2 to 3 ft., rose-purple, with crimson spots.

Godetia Whitneyi: hardy, 1 ft., rosy-red, with crimson spots. The variety

Lady Albemarle is wholly crimson, and very handsome.

Gypsophila elegans: hardy, 1½ ft., pale rose; branched, very graceful.

Helianthus cucumerifolius: hardy, 3 to 4 ft., golden yellow, black disk; branching, free, and bold without coarseness.

Helichrysum bracteatum (fig. 88): half-hardy, 2 ft.; the incurved crimson, rose, and other forms very handsome.



FIG. 88.—*Helichrysum bracteatum incurvum*.

Hibiscus Trionum (africanus): hardy, 1½ ft., cream colour, black centre.
Iberis umbellata (Candytuft): hardy, 1 ft., white, rose, purple, crimson. Some new dwarf white and flesh-coloured varieties are very handsome.

Kaulfussia amelloides: hardy, 1 ft., blue or rose; the var. *kermesina* is deep crimson.

Königa maritima (Sweet Alyssum): hardy, 1 ft., white; fragrant, compact.

Lavatera trimestris: hardy, 3 ft., pale rose showy malvaceous flowers.

Leptosiphon densiflorus: hardy in light soil, 1 ft., purplish or rosy-lilac.

Leptosiphon roseus: hardy in light soil, 6 in., delicate rose; fine in masses.

Linaria bipartita splendida: hardy, 1 ft., deep purple.

Linum grandiflorum (fig. 89): hardy, 1 ft., splendid crimson; var. *roseum* has pink flowers.

Lupinus luteus: hardy 2 ft., bright yellow, fragrant.

Lupinus mutabilis Cruckshanksii: hardy, 4 ft., blue and yellow; changeable.

Lupinus nanus: hardy, 1 ft., bluish-purple; abundant flowering.

Malcolmia maritima (Virginian Stock): hardy, 6 in., lilac, rose, or white.

Malope trifida: hardy, 3 ft., rich glossy purplish-crimson; showy.

Matthiola græca (Wallflower-lvd. Stock): hardy, 1 ft., various as in Stock.

Mesembryanthemum tricolor: half-hardy, 3 in., pink and crimson, with dark centre.

Mimulus cupreus: half-hardy, 6 in., coppery red, varying considerably.

Mimulus luteus tigrinus: half-hardy, 1 ft., yellow spotted with red; var. duplex has hose-in-hose flowers.

Mirabilis Jalapa: half-hardy, 3 ft., various colours; flowers evening-scented.

Nemesia floribunda: hardy, 1 ft., white and yellow; pretty and compact.

Nemophila insignis: hardy, 6 in., azure blue with white centre.

Nemophila maculata: hardy, 6 in., white with violet spots at the edge.

Nigella hispanica: hardy, 1½ ft., pale blue, white, or dark purple.

Oenothera odorata: hardy, 2 to 3 ft., yellow; fragrant.

Omphalodes linifolia (Venus's Navelwort): hardy, 1 ft., white.

Papaver Rhoeas flore-pleno: hardy, 2 ft., scarlet and other colours; showy.



FIG. 89.—*Linum grandiflorum*

Papaver somniferum flore-pleno: hardy, 3 ft., white, lilac, rose, &c.; petals sometimes fringed.

Petunia violacea hybrida: half-hardy, 1½ ft., various colours; sow in heat.

Pharbitis hispida: hardy, 6 ft., various; the many-coloured twining *Convolvulus major*.

Platystemon californicus: hardy, 1 ft., sulphur yellow; neat and distinct.

Portulaca splendens: half-hardy, 6 in., crimson, rose, yellow, white, &c. single and double; splendid prostrate plants for sunny rockwork.

Pyrethrum Parthenium aureum: half-hardy, 1 ft.; grown for its golden foliage, and much used for bedding.

Reseda odorata (Mignonette): hardy, 1 ft., greenish, but exquisitely fragrant; there are some choice new sorts.

Rhodanthe maculata: half-hardy, 1½ ft., rosy-pink or white; larger flower-heads than the next.

Rhodanthe Manglesii : half-hardy, 1 ft., rosy-pink ; a drooping everlasting
Salpiglossis sinuata (fig. 90) : half-hardy, 2 to 3 ft., yellow, purple, crimson,
 &c.; much varied and beautifully veined.



FIG. 90.—*Salpiglossis sinuata*.

Sanvitalia procumbens flore-pleno : half-hardy, 6 in., golden yellow ; pro-cumbent.

Saponaria calabrica : hardy, 6 to 8 in., bright rose pink or white ; continu-ous blooming, compact-growing.

Schizanthus pinnatus : hardy, 1 to 2 ft., purple-lilac, prettily blotched ; curiously lobed flowers.

Schizopetalon Walkeri : hardy, 1 ft., white, sweet-scented at night ; curi-ously fringed petals.

Senecio elegans : half-hardy, 1½ ft., white, rose, or purple ; the various double forms are showy.

Silene pendula : hardy, 1 ft., bright rose pink ; very showy in masses ; var. compacta forms close dense tufts.

Silene Pseudo-Atocion : hardy, 1 ft., rose pink ; free-flowering.

Specularia Speculum : hardy, 6 in., reddish-violet ; free-flowering.

Sphenogyne speciosa : half-hardy, 1 ft., orange-yellow, with black ring around the disk.

Tagetes signata : half-hardy, 1½ ft., golden yellow ; continuous blooming, with elegant foliage. The French and African marigolds, favourites of some, are allied to this.

Tropeolum aduncum (Canary Creeper) : half-hardy, 10 ft., yellow, fringed ; an elegant climber.

Viscaria coeli rosa : hardy, 1½ ft., rosy-purple with pale centre ; pretty.

Viscaria oculata cardinalis : hardy, 1½ ft., rosy-crimson ; very brilliant.

Waitea aurea : half-hardy, 1½ ft., golden yellow ; a showy everlasting.

Xeranthemum annuum flore-pleno : hardy, 2 ft., lilac-purple ; floriferous.

The following annuals are entitled to separate notice :—

The *China Aster* (*Callistephus chinensis*). The groups of asters are very numerous ; but some of the best for ornamental gardening are the chrysanthemum-flowered (fig. 91) the pæony-flowered, the crown or cockade, and the globe-quilled, of each of which there are from six to a dozen distinct colours. What are called crown asters have a white centre and dark crimson or purple circumference, and are very beautiful. The colours range from white and blush through pink and rose to crimson, and from lilac through blue to purple, in various shades. These should be sown early in April in pans, in



FIG. 91.—Chrysanthemum-flowered Aster.

a gentle heat, the young plants being quickly transferred to a cool pit, and there pricked out in rich soil as soon as large enough, and eventually planted out in the garden in May or June, in soil which has been well worked and copiously manured, where they grow from 8 to 18 inches high, and flower in great beauty towards the end of summer. They also make very handsome pot plants for the conservatory.

The *Stock* (*Matthiola annua*). These also are much varied both in respect to habit and colour, and of some of the forms as many as two dozen colours are cultivated, some of which are very

beautiful. The Ten-week and the large-flowered German are both handsome strains. The fragrance of these flowers renders them universal favourites. They should be treated much the same as asters for autumn-blooming plants, but for early blooming require to be sown about August, and wintered in pots in a cold frame, for which purpose the Intermediate Stock is the best adapted. They grow from 1 to 2 feet high, according to the variety.

The *Snapdragon* (*Antirrhinum majus*), which grows about 2 feet high, should be sown in February in a warm pit; prick off in pots, and subsequently into boxes, drawing off into a cool frame when established, and planting out in May or June. They are not true annuals, but may be treated as such.

The *Chinese* or *Indian Pink* (*Dianthus chinensis*, and its varieties *Heddewigii* and *laciniatus*) and several allied forms, which grow from 6 inches to a foot high, are very richly coloured, and highly varied in marking. Sow in pits in gentle heat, in March, transferring them quickly after germination to a cool pit, that they may not get drawn or leggy; they may be planted out in May. They will also flower later on in favourable seasons, if sown outdoors early in April.

The *Larkspur* affords two distinct types, the Rocket Larkspur (*Delphinium Ajacis*), which varies from a foot to a foot and a half, and the branching Larkspur (*D. Consolida*), growing 3 feet high, of each of which there are various colours, double and single. The candelabrum form of the latter is very handsome. Sow in March in the open border where they are to flower.

The *Phlox Drummondii*, a spreading plant about a foot high, of which there are now many varieties of colour, is one of the most beautiful of all annuals, and very prolific of blossom. Sow in the places where it is to flower, in April, in good firm soil.

The *Sweet Pea* (*Lathyrus odoratus*) is indispensable in every garden, especially Painted Lady (white and rose) and the improved forms called Invincible Scarlet and Invincible Black. Sow in rows or patches in February, and again in March, in good rich soil. The plants grow 3 to 4 feet high, and require stakes to support the stems.

The *Nasturtium* (*Tropæolum majus*), in its dwarf form known as Tom Thumb (*T. m. nanum*), is an excellent bedding or border flower, growing about a foot high, each plant forming a dense patch full of flowers, and blooming on for a considerable period if kept growing. The scarlet, the yellow, and the rose-coloured are very

attractive. Sow in April in the beds or borders ; and again in May for a succession.

The *Zinnia elegans*, of which both single and double forms are cultivated, grows about 2 feet high, and produces flowers of various colours, the double ones (fig. 92) being about the size of



FIG. 92.—*Zinnia elegans* fl. pleno.

asters, and very handsome. The colours include white, yellow, orange, scarlet, crimson, and purple. It is half-hardy, and should be sown and treated much the same as the aster.

HARDY BIENNIALS.

Biennials live as half-developed plants throughout one winter. They require to be sown in the summer months, about June or July, in order to get established before winter ; they should be pricked out as soon as large enough, and should have ample space so as to become hardy and stocky. They should be planted in good soil, but not of too stimulating a character. Those that are perfectly hardy are best planted where they are to flower in good time during autumn. This transplanting acts as a kind of check, which is rather beneficial than otherwise. Of those that are liable to suffer injury in winter, as the Brompton and Queen Stocks, a portion should be potted and wintered in cold frames ventilated as freely as the weather will permit.

The number of biennials is not large, but a few very desirable garden plants, such as the following, occur amongst them :—

Agrostemma coronaria (Rose Campion): hardy, 1½ ft., bright rose-purple or rose and white.

Beta Cicla variegata: hardy, 2 ft., beautifully coloured leaves and midribs, crimson, golden, &c.

Campanula Medium (Canterbury Bell): hardy, 2 ft., blue, white, rose, &c. The double-flowered varieties of various colours are very handsome.

Campanula Medium calycanthema: hardy, 2 ft., blue or white; hose-in-hose flowered.

Catananche coerulea: hardy, 2 to 3 ft., blue or white

Celsia cretica: hardy, 4 to 5 ft., yellow, with two dark spots near centre; in spikes.

Dianthus barbatus, fig. 93 (Sweet William): hardy, 1 to 1½ ft., crimson, purple, white, or parti-coloured.



FIG. 93.—*Dianthus barbatus*.

Dianthus chinensis (Indian Pink): half hardy, 1 ft., various; these flower earlier if treated as biennials.

Digitalis purpurea (Foxglove): hardy, 3 to 5 ft., rosy-purple or white; beautifully spotted in the variety called *gloxiniæflora*.

Echium pomponium: hardy, 4 ft., rosy-pink.

Hedysarum coronarium (French Honeysuckle): hardy, 2 to 3 ft., scarlet or white; fragrant.

Hesperis tristis (Night-scented Rocket): hardy, 3 ft., dull purplish; fragrant at night.

Lunaria biennis (Honesty): hardy, 2 to 3 ft., purple; the silvery dissepiment attractive among everlastings.

Oenothera Lamarckiana (Evening Primrose): hardy, 5 ft., bright yellow; large.

Scabiosa atropurpurea (Sweet Scabious): hardy, 3 ft., dark purple, showy; the variety *nana flore-pleno* is dwarfer and has double flowers.

Silene compacta: half-hardy, 2 to 3 ft., bright pink; clustered as in *S. Armeria*.

Verbascum Blattaria: hardy, 3 to 4 ft., yellowish, with purple hairs on the filaments; in tall spikes.

The *Stock*.—The most important of the biennials are the different

kinds of Stocks. The *Intermediate Stock* (*Matthiola annua intermedia*) is one of the so-called scarlet stocks, and is very useful, when preserved through the winter in frames, for its dwarfness and early-flowering habit. It is used very extensively for furnishing jardinières, window boxes, flower beds, &c., during the London season, for which purpose it is sown in July and August, while if sown in spring it blooms in autumn, and furnishes a useful succession crop of flowers. Of the East Lothian stock, which is a somewhat larger grower, there are some half dozen colours, those called New Crimson and Mauve Beauty being specially admired; these are sown in July and August for summer blooming, and early in spring for flowering in autumn.

The *Brompton Stock* (*Matthiola incana simplicicaulis*) is a robust plant, growing 3 feet high, with a long central flower stem bearing very large flowers, which are crimson, purple, or white. They require rich soil, and should be sown in June or July, being pricked out into nursery beds, and planted in September in the borders where they are to bloom. Two or three plants should be put in one patch, as then any surplusage of single-flowered individuals may be pulled away.

The *Queen* or *Twickenham Stock* (*Matthiola incana semperflorens*) is less vigorous in habit than the Brompton, and is of more spreading habit, the plants growing about 2 feet high, with the lateral branches very much developed. There are the three usual colours, purple, scarlet, and white, the first-named being a special favourite. They require to be sown in June or July, and planted out in September, so as to get well established before winter, and if they have the advantage of good soil they will flower freely in the early part of the ensuing summer. Sometimes the plants acquire almost a woody habit, and live over the second year, but the flowers are not equal to those produced the first blooming season.

HARDY PERENNIALS.

This term includes, not only those fibrous-rooted plants of herbaceous habit which spring up from the root year after year, but also those old-fashioned subjects known as florists' flowers, and the hardy bulbs. Some of the most beautiful of hardy flowering plants belong to this class, and their great variety, as well as the long period through which they, one or other of them, yield their flowers, are beginning again to secure them some of the consideration which has long been given mainly to bedding plants.

When the length of the flowering season is considered, it will be

obvious that it is impossible to keep up the show of a single border or plot for six months together, since plants, as they are commonly arranged, come dropping into flower one after another ; and even where a certain number are in bloom at the same time, they necessarily stand apart, and so the effects of contrast, which can be perceived only among adjacent objects, are lost. To obviate this defect, it has been recommended that ornamental plants should be formed into four or five separate suites of flowering, to be distributed over the garden. Not to mention the more vernal flowers, the first might contain the flora of May; the second that of June; the third that of July ; and the fourth that of August and the following months. These compartments should be so intermingled that no particular class may be entirely absent from any one quarter of the garden.

Before commencing to plant, it would be well to construct tables or lists of the plants, specifying their respective times of flowering, colours, and altitudes. To diversify properly and mingle well together the reds, whites, purples, yellows, and blues, with all their intervening shades, requires considerable taste and powers of combination ; and ascertained failures may be rectified at the proper time the next season. The one great object aimed at should be to present an agreeable contrast ; and, as at particular seasons a monotony of tint prevails, it is useful at such times to be in possession of some strong glaring colours. White, for instance, should be much employed in July, to break the duller blues and purples which then preponderate. Orange, too, is very effective at this season. On the other hand, yellows are superabundant in autumn, and therefore reds and blues should then be sought for. The flower-gardener should have a small nursery, or reserve garden, for the propagation of the finer plants, to be transferred into the borders as often as is required.

As a rule, all the fibrous-rooted herbaceous plants flourish in good soil which has been fairly enriched with manure, that of a loamy character being the most suitable. Many of them also grow satisfactorily in a peaty soil if well worked, especially if they have a cool moist subsoil. Pentstemons and phloxes, amongst others, do well in soil of this character, but the surface must be well drained ; the former are rather apt to perish in winter in loamy soil, if at all close and heavy. The herbaceous border should be a distinct compartment, and not less than 10 feet in width, backed up by evergreens. Such a border will take in about four lines of plants, the tallest being placed at the back and the others graduated in height down

to the front. In the front row patches of the white arabis, the yellow alyssum, and the purple aubrietia, recurring at intervals of 5 or 6 yards on a border of considerable length, carry the eye forwards and give a balanced kind of finish to the whole. The same might be done with dianthus or the larger narcissi in the second row, with pæonies, columbines, and phloxes in the third, and with delphiniums, aconitums, and some of the taller yellow composites as helianthus and rudbeckia at the back. Spring and autumn flowers, as well as those blooming in summer, should be regularly distributed throughout the border, which will then at no season be devoid of interest in any part. Many of the little alpine may be brought into the front line planted between suitable pieces of stone, or they may be relegated to a particular spot, and placed on an artificial rockery. Most of the hardy bulbs will do well enough in the border, care being taken not to disturb them while leafless and dormant.

Some deep-rooting perennials do not spread much at the surface, and only require refreshing from time to time by top-dressings. Others, as the asters, spread rapidly; those possessing this habit should be taken up every second or third year, and, a nice patch being selected for replanting from the outer portions, the rest may be either thrown aside, or reserved for increase; the portion selected for replanting should be returned to its place, the ground having meanwhile been well broken up. Some plants are apt to decay at the base, frequently from exposure caused by the lifting process going on during their growth; these should be taken up annually in early autumn, the soil refreshed, and the plants returned to their places, care being taken to plant them sufficiently deep.

Only a selection of some of the best of the decorative hardy perennials can be noted, before we pass on to those popular subjects of this class which have been directly influenced by the hybridizer and improver. Many more might be added to the subjoined list:—

Acæna.—Neat trailing plants adapted for rockwork, thriving in sandy soil. *A. microphylla* and *A. myriophylla* have pretty spiny heads of flowers.

Acantholimon.—Pretty dwarf tufted plants, with needle-shaped leaves, adapted for rockwork. *A. glumaceum* and *A. venustum* bear bright pink flowers in July and August. Light sandy loam.

Acanthus.—Bold handsome plants, with stately spikes, 2 to 3 feet high, of flowers with spiny bracts. *A. mollis*, *A. latifolius*, and *A. longifolius* are broad-leaved sorts; *A. spinosus* and *A. spinosissimus* have narrower spiny toothed leaves.

Achillea.—Handsome composite plants, the stronger ones of easy culture in common soil. *A. Eupatorium* and *filipendula*, 3 to 4 feet, have showy yellow corymbose flowers; *A. rosea*, 2 feet, rosy-crimson; and *A. Ptarmica flore-pleno*, 2 feet, double white flowers. Others suitable for front lines

or rockwork are *A. tomentosa*, 9 inches, bright yellow; *A. aegyptiaca*, 1 foot, silvery leaves and yellow flowers; *A. umbellata*, 8 inches, silvery leaves and white flowers; and *A. Clavennae*, 6 inches, with silvery leaves and pure white flowers.

Aconitum.—Handsome border plants, the tall stems crowned by racemes of showy hooded flowers. *A. Camarum*, 3 to 4 feet, has deep purple flowers in August; *A. sinense*, 1½ to 2 feet, has large dark purple flowers in September; *A. variegatum*, 3 feet, has the flowers white edged with blue; *A. autumnale*, 3 feet, has pale blue flowers, and *A. japonicum*, 2½ feet, deep blue flowers, both produced in September and October.

Adenophora.—Bell-shaped flowers. *A. stylosa*, 2 feet, pale blue, elegant; *A. denticulata*, 1½ feet, dark blue; and in *A. lilifolia*, 1½ feet, pale blue, sweet-scented—all blooming during summer. Light soil.

Adonis.—*A. vernalis*, 1 foot, has large bright yellow stellate flowers in April. Deep light soil.

Ajuga.—Free-growing, dwarf, and showy. *A. reptans*, 8 inches, has



FIG. 94.—*Amaryllis Belladonna*.

creeping runners, which *A. genevensis* has not; both bear handsome spikes of blue labiate flowers. Ordinary soil.

Allium.—Hardy bulbs of the garlic family, some species of which are ornamental; the inflorescence is umbellate. In *A. azureum*, 1 to 2 feet, the flowers are deep-blue; in *A. Moly*, 1 foot, golden yellow; in *A. neapolitanum*, 1½ feet, white, very handsome; in *A. triquetrum*, 8 inches, white with green central stripes; in *A. pedemontanum*, 9 inches, reddish-violet, very beautiful, the umbels nodding.

Ailströmeria.—Beautiful plants with fleshy tuberous roots, which are the better if not often disturbed. *A. aurantiaca*, 2 to 3 feet, orange streaked with red, in July and August; *A. chilensis*, 2 to 3 feet, blood-red, streaked with

yellow, affording many varieties. Deep sandy loam or peat. Should be planted at least 6 or 8 inches deep.

Alyssum.—Showy rockwork or front row border plants of easy culture in any light soil; the plants should be frequently renewed from cuttings. *A. saxatile*, with greyish leaves, and deep yellow flowers, produced in April and May, and the dwarfier *A. montanum*, are useful.

Amaryllis.—Noble half-hardy bulbs, for planting near the front wall of a hot-house or greenhouse; the soil must be deep, rich, and well-drained. *A. Belladonna* (fig. 94), the Belladonna Lily, 3 feet, has large funnel-shaped flowers in September, of a delicate rose colour. The variety *A. blanda* has paler flowers, almost white.

Anchusa.—Pretty boraginaceous herbs, easily grown. *A. italica*, 3 to 4 feet, has blue star-like flowers. *A. sempervirens*, 1½ feet, rich blue, is well suited for rough borders.

Androsace.—Pretty dwarf rock plants, requiring rather careful management and a gritty soil. *A. Vernalis*, yellow; *A. Wulfeniana*, purplish-crimson; *A. villosa*, white or pale rose; *A. lactea*, white with yellow eye; *A. lanuginosa*, delicate rose; and *A. Chamæjaume*, delicate rose, are some of the best.

Antennaria.—Composite plants, with everlasting flowers. *A. margaritacea*, 1½ to 2 feet, has white woolly stems and leaves, and white flower-heads.



FIG. 95.—*Aquilegia chrysantha*.

Anthericum.—Charming border flowers. *A. Lillastrum*, St Bruno's Lily, 1½ feet, bears pretty white sweet-scented flowers in May. *A. Hookeri* (Chrysobactron), 2 feet, with long racemes of bright golden yellow flowers, requires cool peaty soil.

Aquilegia.—The Columbine family, consisting of beautiful border flowers

in great variety, ranging from 1 to 2 or 3 feet in height. Besides the common purple *A. vulgaris* with its numerous varieties, double and single, there are of choice sorts *A. alpina* and *A. pyrenaica*, blue; *A. glandulosa*, *A. jucunda*, and *A. cœrulea*, blue and white; *A. leptoceras*, blue and yellow; *A. canadensis*, *A. Skinneri*, and *A. truncata* (californica), scarlet and yellow; *A. chrysantha* (fig. 95), yellow; and *A. fragrans*, white or flesh-colour, very fragrant. Light rich garden soil.

Arabis.—Dwarf close-growing evergreen cruciferous plants, adapted for rockwork and the front part of the flower border, and of the easiest culture. *A. albida* forms a conspicuous mass of greyish leaves and white blossoms; *A. lucida*, which is also white-flowered, bears its bright green leaves in rosettes, and has a variety with prettily gold-margined leaves.

Arenaria.—Evergreen rock plants of easy culture. *A. graminifolia* and *A. laricifolia* are tufted, with grassy foliage and white flowers, while *A. balearica*, a creeping plant, has broad leaves and solitary white flowers.

Armeria.—The Thrift or Sea-Pink, of which the common form *A. maritima* is sometimes planted as an edging for garden walks; there are three varieties, the common pale pink, the deep rose, and the white, the last two being the most desirable. *A. cephalotes*, 1½ feet, is a larger plant, with tufts of linear lance-shaped leaves, and abundant globular heads of deep rose flowers, in June and July.

Arum.—Remarkable plants, with tuberous roots, and erect hood-like spathes, enclosing the spike of flowers (spadix). *A. crinitum*, 1½ feet, has pedate leaves, and fetid dark chocolate hairy spathes; *A. Dracunculus*, 3 feet, has spotted stems, pedate leaves, and dull purple spathes; *A. italicum*, with greenish spathes, has the cordate hastate leaves conspicuously veined with white.

Asclepias.—*A. tuberosa* is a handsome fleshy-rooted plant, very impatient of being disturbed, and preferring good peat soil; it grows 1 to 1½ feet high, and bears corymbs of deep yellow and orange flowers in September. *A. incarnata*, 2 to 4 feet, produces deep rose sweet-scented flowers towards the end of summer.

Asphodelus.—Handsome liliaceous plants, with fleshy roots, erect stems, and showy flowers, thriving in any good garden soil. *A. albus*, 4 feet, *A. æstivus*, 4 feet, and *A. ramosus*, 4 feet, have all long tapering keeled leaves, and simple or branched spikes of white flowers; *A. luteus*, 2 feet, has awl-shaped leaves and dense spikes of fragrant yellow flowers; *A. capillaris* is similar to *A. luteus*, but more slender and elegant.

Aster.—A very large family of autumn-blooming composites, including some ornamental species, all of the easiest culture. Of these, *A. alpinus*, 1 foot, and *A. Amellus*, 1½ feet, with its var. *bessarabicus*, have broadish blunt leaves, and large starry bluish flowers; *A. longifolius formosus*, 2 feet, bright rosy lilac; *A. elegans*, 3 to 5 feet, small pale purple or whitish; *A. laxus*, 2 feet, purplish-blue; *A. pendulus*, 2½ feet, white, changing to rose; *A. pyrenæus*, 2 to 3 feet, lilac-blue; *A. turbinellus*, 2 to 3 feet, mauve-coloured, are showy border plants; and *A. Novæ Angliæ*, 5 to 6 feet, rosy-violet; *A. cyaneus*, 5 feet, blue-lilac; and *A. grandiflorus*, 3 feet, violet, are especially useful from their late-flowering habit.

Astilbe.—*A. japonica*, 1 to 1½ feet, better known as *Hoteia japonica* or *Spiræa japonica*, thrives in peaty or sandy soil; its glossy tripinnate leaves, and feathery panicles of white flowers early in summer, are very attractive. It proves to be a fine decorative pot-plant, and invaluable for forcing during the spring. The variety named *aureo-variegata* has the green leaves beautifully reticulated with golden-yellow veins.

Astragalus.—Showy pea-flowered plants, the smaller species adapted for rockwork; sandy soil. *A. dasyglottis*, 6 inches, has bluish-purple flowers in August and September; and *A. monspessulanus*, 8 inches, crimson-purple in July; while *A. hypoglottis*, 6 inches, produces in summer compact heads of pretty flowers, which are either purple or white. There are many very ornamental kinds.

Aubrietia.—Beautiful dwarf spring-blooming rock plants, forming carpety tufts of flowers of simple cruciferous form. *A. deltoidea* is of a deep lilac-blue; *A. Campbellii* is more compact and rather darker, approaching to purple; *A. grandiflora* and *græca* are rather larger, but of a lighter hue. Light sandy soil.

Bambusa.—The Bamboo family, some of which are hardy, at least in sheltered positions, are elegant arborescent grasses. *B. japonica* or Metake, 4 to 7 feet, has broadish leaves; *B. nigra* is about the same height, but more slender; *B. aurea*, 6 to 10 feet, is slender and graceful; and *B. (Arundinaria) falcata* sometimes reaches 20 feet in height.

Baptisia.—Stoutish erect-growing, 2 to 3 feet, with smooth foliage and spikes of leguminous flowers. *B. australis* is purplish-blue, *B. alba*, white, *B. exaltata*, deep blue; all flowering in the summer months.



FIG. 96.—*Brodiaea coccinea*.

Bellis.—*B. perennis flore-pleno*, the Double Daisy, consists of dwarf showy 3 to 4 inch plants, flowering freely in spring if grown in rich light soil, and frequently divided and transplanted. The white and pink forms, with the white and red quilled, and the variegated-leaved *aucubæfolia*, are some of the best.

Bocconia.—Stately poppyworts, 6 to 8 feet. *B. cordata* has heart-shaped lobed leaves, and large panicles of small flesh-coloured flowers. Sometimes called *Macleaya*. Deep sandy loam.

Brodiaea.—Pretty bulbous plants. *B. grandiflora*, 1 foot, has large bluish-

purple flowers; *B. coccinea* (fig. 96), 2 to 3 feet, has tubular campanulate nodding flowers of a rich crimson with green tips. Sandy loam.

Bulbocodium.—Pretty spring-flowering crocus-like bulbs. *B. vernum*, 4 to 6 inches high, purplish-lilac, blooms in March. Good garden soil.

Euphthalmum.—Robust composite herbs with striking foliage, for the back of herbaceous or shrubby borders. *B. cordifolium*, 4 feet, has large cordate leaves, and heads of rich orange flowers in cymose panicles in July. Also called *Telekia speciosa*.

Calandrinia.—Showy dwarf plants for sunny rockwork, in light sandy soil. *C. umbellata*, 3 to 4 inches, much branched, with narrow hairy leaves, and corymbs of magenta-crimson flowers in the summer months.

Caltha.—Showy marsh plants, adapted for the margins of lakes, streamlets, or artificial bogs. *C. palustris flore-pleno*, 1 foot, has double brilliant yellow flowers in May.

Calystegia.—Twining plants with running perennial roots. *C. pubescens flore-pleno*, 8 to 10 feet, has showy double-pink convolvuloid flowers in July; *C. dahurica* is a handsome single-flowered summer-blooming kind, with rosy-coloured flowers.

Campanula.—Beautiful, as well as varied in habit and character. They are called bell-flowers. *C. pulla*, 6 inches, purplish, nodding, on slender erect stalks; *C. trachelium*, 9 inches, purple, broad-belled; *C. carpatia*, 1 foot, blue, broad-belled; *C. nobilis*, 1½ feet, long-belled, whitish or tinted with chocolate; *C. persicifolia*, 2 feet, a fine border plant, single or double, white or purple, blooming in July; and *C. pyramidalis*, 6 feet, blue or white, in tall branching spikes, are good and diverse. There are many other fine sorts.

Centaurea.—Bold-habited composites of showy character; common soil. *C. babylonica*, 5 to 7 feet, has winged stems, silvery leaves, and yellow flower-heads from June to September; *C. montana*, 3 feet, deep bright blue or white.

Centranthus.—Showy free-flowering plants, for rockwork, banks, or stony soil. *C. ruber*, 2 feet, branches and blooms freely all summer, and varies with rosy, or crimson, or white flowers. It clothes the chalk cuttings on some English railways with a sheet of colour in the blooming season.

Cheiranthus.—Pretty rock plants, for light stony soils. *C. alpinus*, 6 inches, grows in dense tufts, and bears sulphur-yellow flowers in May. *C. ochroleucus* is similar in character.

Chionodoxa.—Charming dwarf hardy bulbous plants of the liliaceous order, blooming in the early spring in company with *Scilla sibirica*, and of equally easy cultivation. *C. Lucillie*, 6 inches, has star-shaped flowers of a brilliant blue with a white centre, and is the finest of the few known species. It blooms about April.

Colchicum.—Showy autumn-blooming bulbs (corms), with crocus-like flowers, all rosy-purple or white. *C. speciosum*, *C. autumnale*, single and double, *C. byzantinum*, and *C. variegatum* are all worth growing.

Convallaria.—*C. majalis*, the Lily of the Valley, a well-known sweet-scented favourite spring flower, growing freely in rich garden soil; its spikes, 6 inches high, of pretty white fragrant bells, are produced in May and June; the variety with gold-striped leaves is very ornamental.

Coreopsis.—Effective composite plants, thriving in good garden soil. *C. auriculata*, 2 to 3 feet, has yellow and brown flowers in July and August; *C. grandiflora*, 3 to 4 feet, bright yellow, in August; *C. tenuifolia*, 2 feet, rich golden yellow, in July.

Corydalis.—Interesting and elegant plants, mostly tuberous, growing in good garden soil. *C. bracteata*, 9 inches, has sulphur-coloured flowers in April, and *C. nobilis*, 1 foot, rich yellow, in May; *C. solida*, with purplish, and *C. tuberosa*, with white flowers, are pretty spring-flowering plants, 4 to 6 inches high.

Cyclamen.—Charming tuberous-rooted plants of dwarf habit, suitable for sheltered rockeries, and growing in light gritty soil. *C. europæum*, reddish-purple, flowers in summer, and *C. hederifolium* in autumn.

Cypripedium.—Beautiful terrestrial orchids, requiring to be planted in peat soil, in a cool and rather shady situation. *C. spectabile*, 1½ to 2 feet, white and rose colour, in June, is a lovely species, as is *C. Calceolus*, 1 foot, yellow and brown, in May; all are full of interest and beauty.

Delphinium.—The Larkspur family, tall showy plants, with spikes of blue flowers in July. Many popular garden varieties have been raised from seeds. *D. grandiflorum* and *D. grandiflorum flore-pleno*, 2 to 3 feet, are distinct, and of the richest dazzling blue, flowering on till September. *D. chinense*, 2 feet, blue, and its double-flowered variety, are good, as is *D. Barlowi*, 3 feet, a brilliant double blue purple. *D. nudicaule*, 2 feet, orange-scarlet, very showy, is best treated as a biennial, its brilliant flowers being produced freely in the second year from the seed.

Dianthus.—Chiefly rock plants with handsome and fragrant flowers, the smaller sorts growing in light sandy soil, and the larger border plants in rich garden earth. Of the dwarfier sorts for rock gardens, *D. alpinus*, *D. cæsius*, *D. deltoides*, *D. dentosus*, *D. neglectus*, *D. petreus*, and *D. glacialis* are good examples; while for borders or larger rockwork *D. plumarius*, *D. superbus*, *D. Fischeri*, *D. cruentus*, and the clove section of *D. Caryophyllus* are most desirable.

Dictamnus.—*D. Fraxinella* is a very characteristic and attractive plant, 2 to 3 feet, with bold pinnate leaves, and tall racemes of irregular-shaped purple or white flowers. It is everywhere glandular, and strongly scented.

Dielytra.—Very elegant plants, of easy growth in good soil. *D. spectabilis*, 2 to 3 feet, has pæony-like foliage, and gracefully drooping spikes of heart-shaped pink flowers, about May, but it should have a sheltered place, as it suffers from spring frosts and winds; *D. formosa* and *D. eximia*, 1 foot, are also pretty rosy-flowered species.

Digitalis.—Stately erect-growing plants, with long racemes of pouch-shaped drooping flowers. The native *D. purpurea*, or Foxglove, 3 to 5 feet, with its dense racemes of purple flowers, spotted inside, is very showy, but is surpassed by the garden variety called *gloxinioides*. The yellow-flowered *D. lutea* and *D. grandiflora* are less showy. Good garden soil, and frequent renewal from seeds.

Doronicum.—Showy composites of free growth in ordinary soil. *D. caucasicum* and *D. austriacum*, 1 to 1½ feet, both yellow-flowered, bloom in spring and early summer.

Draba.—Good rockwork cruciferous plants. *D. alpina*, *D. aizoides*, *D. ciliaris*, *D. aizoon*, and *D. cuspidata* bear yellow flowers in early spring; *D. cinerea* and *D. ciliata* have white flowers. Gritty well-drained soil.

Dracocephalum.—Handsomeness labiate plants, requiring a warm and well-drained soil. *D. argunense*, 1½ feet, *D. austriacum*, 1 foot, *D. grandiflorum*, 1 foot, and *D. Ruyschiana*, 1½ feet, with its var. *japonicum*, all produce showy blue flowers during the summer months.

Echinacea.—Stout growing showy composites for late summer and autumn flowering, requiring rich deep soil, and not to be often disturbed. *E.*

angustifolia, 3 to 4 feet, light purplish-rose, and *E. intermedia*, 3 to 4 feet, reddish-purple, are desirable kinds.

Epimedium.—Pretty plants, growing about a foot high, with elegant foliage, and curious flowers. *E. macranthum*, white flowers, and *E. rubrum*, red, are distinctly spurred; *E. pinnatum* and *E. Perralderianum*, yellow, less so. They bloom in spring, and prefer a shady situation and a peaty soil.

Erigeron.—Composite plants, variable in character. *E. purpureus*, 1½ feet, with pink flower-heads, having narrow twisted ray-florets; *E. Roylei*, 1 foot, dark blue; and *E. pulchellus*, 1 foot, rich orange, flowering during the summer, are among the best kinds. Good ordinary garden soil.

Erinus.—*E. alpinus* is a beautiful little alpine for rockwork, 3 to 6 inches, of tufted habit, with small-toothed leaves, and heads of pinkish-purple or, in a variety, white flowers, early in summer. Sandy well-drained soil.

Erodium.—Handsome dwarf tufted plants. *E. Manescavi*, 1 to 1½ feet, has large purplish-red flowers in summer; *E. Reichardi*, a minute stemless plant, has small heart-shaped leaves in rosette-like tufts, and white flowers striped with pink, produced successively. Light soil.

Eryngium.—Very remarkable plants of the umbelliferous order, mostly of an attractive character. *E. amethystinum*, 2 feet, has the upper part of the stem, the bracts, and heads of flowers all of an amethystine blue. Some of more recent introduction have the aspect of the pine-apple, such as *E. bromeliæfolium*, *E. pandanifolium*, and *E. eburneum*. Deep light soil.



FIG. 97.—*Erythronium dens canis*.

Erythronium.—*E. dens canis* (fig. 97), the Dog's-Tooth Violet, is a pretty dwarf bulbous plant with spotted leaves, and rosy or white flowers produced in spring, and having reflexed petals. Mixed peaty and loamy soil, deep and cool.

Euphorbia.—Plants whose beauty resides in the bracts or floral leaves which surround the inconspicuous flowers. *E. aleppica*, 2 feet, and *E.*

Characias, 2 to 3 feet, with green bracts, are fine plants for rockwork or sheltered corners.

Ferula.—Gigantic umbelliferous plants, with magnificent foliage, adapted for shrubby borders or open spots on lawns. They have thick fleshy roots, deeply penetrating, and therefore requiring deep soil, which should be of a light or sandy character. *F. communis*, *F. glauca*, and *F. tingitana*, the last with glossy lozenge-shaped leaflets, grow 8 to 10 feet high; *F. Ferulago*, with more finely cut leaves, grows 5 to 6 feet high. They flower in early spring, and all have a fine appearance when in bloom, on account of their large showy umbels of yellow flowers.

Funkia.—Pretty liliaceous plants, with simple conspicuously longitudinal-ribbed leaves, the racemose flowers funnel-shaped and deflexed. *F. Sieboldiana*, 1 foot, has lilac flowers; *F. grandiflora*, 18 inches, is white and fragrant; *F. coerules*, 18 inches, is violet-blue; *F. albo-marginata*, 15 inches, has the leaves edged with white, and the flowers lilac. Rich garden soil.

Gaillardia.—Showy composite plants, thriving in good garden soil. *G. aristata*, 2 feet, has large yellow flower-heads, 2 or 3 inches across, in summer; *G. Baeselari* and *G. Loiselii* have the lower part of the ray-florets red, the upper part yellow.



FIG. 98.—*Galanthus nivalis*.

Galanthus.—The Snowdrop. Early spring-flowering amaryllidaceous bulbs, with pretty drooping flowers, snow-white, having the tips of the enclosed petals green. The common sort is *G. nivalis* (fig. 98), which blossoms on

the first break of the winter frosts *G. Imperati* and *G. plicatus* have larger flowers.

Gaura.—*G. Lindheimeri*, 3 to 5 feet, is much branched, with elegant white and red flowers of the onagraceous type, in long slender ramose spikes during the late summer and autumn months. Light garden soil; not long-lived.

Gentiana.—Beautiful tufted erect-stemmed plants preferring a strong rich loamy soil. *G. acaulis*, known as the *Gentianella*, forms a close carpet of shining leaves, and in summer bears large erect tubular deep blue flowers. *G. Andrewsii*, 1 foot, has, during summer, large deep blue flowers in clusters, the corollas closed at the mouth; *G. asclepiadea*, 18 inches, purplish-blue, flowers in July.

Geranium.—Showy border flowers, mostly growing to a height of 1½ or 2 feet, having deeply cut leaves, and abundant saucer-shaped blossoms of considerable size. *G. ibericum*, *platypetalum*, and *Backhousianum* are desirable purple-flowered sorts; *G. sanguineum*, a tufted grower, has the flowers a deep rose colour; and the double-flowered white and blue forms of *G. pratense* and *G. sylvaticum* make pretty summer flowers. Good garden soil.

Geum.—Pretty rosaceous plants. The single and double flowered forms of *G. chilense*, 2 feet, with brilliant scarlet flowers, and *G. montana*, 9 inches, yellow, are amongst the best sorts. Good garden soil.

Gynierium.—The Pampas-Grass, a noble species, introduced from Buenos Ayres; it forms huge tussocks, 4 or 5 feet high, above which towards autumn rise the bold dense silvery plumes of the inflorescence. It does best in sheltered nooks.

Gypsophila.—Interesting caryophyllaceous plants, thriving in dryish situations. *G. paniculata*, 2 feet, from Siberia, forms a dense semi-globular mass of small white flowers from July onwards till autumn, and is very useful for cutting.

Helenium.—Showy composites of free growth in lightish soil. *H. autumnale*, 4 feet, bears a profusion of yellow-rayed flower-heads in August and September.

Helianthemum.—Dwarf subshrubby plants well suited for rockwork, and called Sun-Roses from their blossoms resembling small wild roses, and their thriving best in sunny spots. Some of the handsomest are *H. roseum*, *mutabile*, *cupreum*, and *rhodanthum*, with red flowers; *H. vulgare flore-pleno*, *grandiflorum*, and *stramineum*, with yellow flowers; and *H. macranthum* and *papyraceum*, with the flowers white.

Helianthus.—The Sunflower genus, of which there are several ornamental kinds. *H. multiflorus*, 4 feet, and its double-flowered varieties, bear showy golden yellow flower-heads in profusion, and are well adapted for shrubbery borders; *H. orgyalis*, 8 feet, has drooping willow-like leaves.

Helichrysum.—Composite plants, with the flower-heads of the scarious character known as Everlastings. *H. arenarium*, 6 to 8 inches, is a pretty species, of dwarf spreading habit, with woolly leaves and corymbs of golden yellow flowers, about July.

Helleborus.—Charming very early blooming dwarf ranunculaceous herbs. *H. niger* or Christmas Rose, the finest variety of which is called *maximus*, has white showy saucer-shaped flowers; *H. orientalis*, 1 foot, rose-coloured; *H. atrorubens*, 1 foot, purplish-red; and *H. colchicus*, 1 foot, deep purple. Deep rich loam.

Hepatica.—Charming little tufted plants requiring good loamy soil, and sometimes included with *Anemone*. *H. triloba*, 4 inches, has three-lobed

leaves, and a profusion of small white, blue, or pink single or double flowers, from February onwards; *H. angulosa*, from Transylvania, 6 to 8 inches, is a larger plant, with sky-blue flowers.

Hesperis.—*H. matronalis*, 1 to 2 feet, is the old garden Rocket, of which some double forms with white and purplish blossoms are amongst the choicest of border flowers. They require a rich loamy soil, not too dry, and should be divided and transplanted into fresh soil annually or every second year, in the early autumn season.

Hibiscus.—Showy malvaceous plants. *H. Moscheutos*, rose coloured, and *H. palustris*, purple, both North American herbs, 3 to 5 feet high, are suitable for moist borders or for boggy places near the margin of lakes.

Hyacinthus.—Beautiful bulbous plants, of which the popular garden hyacinth is an example. *H. candicans* (fig. 99), and one or two allied species, are from South Africa. *H. candicans* is a noble plant, quite hardy, growing 3 to 4 feet in height, with lorate-lanceolate leaves, and a long raceme of a



FIG. 99.—*Hyacinthus (Galtonia) candicans*.

score or more large handsome bell-shaped white flowers. It is now sometimes called *Galtonia*.

Iberis.—The Candytuft, of which several dwarf spreading subshrubby species are amongst the best of rock plants clothing the surface with tufts of green shoots, and flowering in masses during May and June. The best are *I. saxatilis*, 6 to 10 inches; *I. sempervirens*, 12 to 15 inches; and *I. Frutitil* (variously called *coriacea*, *carnosa*, *correaefolia*), 12 inches.

Lathyrus.—Handsome climbing herbs, increased by seeds or division. *L. grandiflorus*, 3 feet, has large rose-coloured flowers with purplish-crimson wings, in June; *L. latifolius*, the Everlasting Pea, 6 feet, has bright rosy flowers in the late summer and autumn; the vars. *albus*, white, and *superbus*, deep rose, are distinct. Ordinary garden soil.

Lavatera.—*L. thuringiacea*, 4 feet, is a fine erect-growing malvaceous plant, producing rosy-pink blossoms freely, about August and September. Good garden soil.

Leucojum.—Snowflake. Pretty early-blooming bulbs, quite hardy. *L. vernum*, 6 inches, blooms shortly after the snowdrop, and should have a light rich soil and sheltered position; *L. pulchellum*, 1½ feet, blooms in April and May; and *L. aestivum*, 2 feet, in May. All have white pendent flowers, tipped with green.

Liatris.—Pretty composites with the flower-heads collected into spikes. *L. pumila*, 1 foot, *L. squarrosa*, 2 to 3 feet, *L. spicata*, 3 to 4 feet, *L. pycnostachya*, 3 to 4 feet, all have rosy-purplish flowers. Deep, cool, and moist soil.

Linaria.—Toadflax. Pretty scrophulariads, of which *L. alpina*, 3 to 6 inches, with bluish-violet flowers having a brilliant orange spot, is suitable for rockwork; *L. dalmatica*, 4 feet, and *L. genistæfolia*, 3 feet, both yellow flowered, are good border plants.

Linum.—Flax. *L. alpinum*, 6 inches, large, dark blue; *L. narbonense*, 1½ feet, large, blue; *L. perenne*, 1½ feet, cobalt blue; and *L. arboreum* (flavum), 1 foot, yellow, are all pretty. The last is liable to suffer from damp during winter, and some spare plants should be wintered in a frame.

Lithospermum.—*L. prostratum*, 3 inches, is a trailing evergreen herb, with narrow hairy leaves, and paniculate brilliant blue flowers in May and June. Well adapted for rockwork or banks of sandy soil.



FIG. 100.—*Lupinus polyphyllus*.

Lupinus.—Showy erect-growing plants with papilionaceous flowers, thriving in good deep garden soil. *L. polyphyllus* (fig. 100), 3 feet, forms noble tufts of palmate leaves, and long spikes of bluish-purple or white flowers in June and July; *L. arboreus* is subshrubby, and has yellow flowers.

Lychnis.—Brilliant erect-growing caryophyllaceous plants, thriving best in beds of peat earth, or of deep sandy loam. *L. chalcidonica*, 3 feet, has dense heads of bright scarlet flowers, both single and double, in June and July; *L. fulgens*, 1 foot, vermillion; *L. Haageana*, 1½ feet, scarlet; and *L. grandiflora* (fig. 101), 1 foot, coppery-orange, are all large-flowered and showy, but require a little protection in winter.

Malva.—*M. moschata*, 2 feet, with a profusion of pale pink or white flowers,

and musky deeply-cut leaves, though a British plant, is worth introducing to the flower borders when the soil is light and free.

Mertensia.—*M. virginica*, 1 to 1½ feet, azure-blue, shows flowers in drooping panicles in May and June. It does best in shady peat borders.

Mimulus.—Monkey-flower. Free-blooming, showy scrophulariaceous plants, thriving best in moist situations. *M. cardinalis*, 2 to 3 feet, has scarlet flowers, with the limb segments reflexed; *M. luteus* and its many garden forms, 1 to 1½ feet, are variously coloured and often richly spotted; and *M. cupreus*, 8 to 10 inches, is bright coppery-red. *M. moschatus* is the Musk-plant, of which the variety *Harrisoni* is a greatly improved form, with much larger yellow flowers.



FIG. 101.—*Lychnis grandiflora*.

Monarda.—Handsome labiate plants, flowering towards autumn, and preferring a cool soil and partially shaded situation. *M. didyma*, 2 feet, scarlet or white; *M. fistulosa*, 3 feet, purple; and *M. purpurea*, 2 feet, deep purple, are good border flowers.

Muscari.—Pretty dwarf spring-flowering bulbs. *M. botryoides* (Grape Hyacinth), 6 inches, blue or white, is the handsomest; *M. moschatum* (Musk Hyacinth), 10 inches, has peculiar livid greenish-yellow flowers and a strong musky odour; *M. monstrosum* (Feather Hyacinth), bears sterile flowers broken up into a feather-like mass. Good garden soil.

Myosotis.—Forget-me-not. Lovely boraginaceous plants. *M. dissitiflora*, 6 to 8 inches, with large handsome and abundant sky-blue flowers, is the best and earliest, flowering from February onwards; it does well in light cool soils, preferring peaty ones, and should be renewed annually from seeds or cuttings. *M. rupicola*, 2 to 3 inches, intense blue, is a fine rock plant, preferring shady situations and gritty soil; *M. sylvatica*, 1 foot, blue, pink, or white, used for spring bedding, should be sown annually in August.

Nardosmia.—*N. fragrans*, the Winter Heliotrope, though of weedy habit, with ample cordate coltsfoot-like leaves, yields in January and February its abundant spikes, about a foot high, of greyish flowers scented like heliotrope; it should have a corner to itself.

Nepeta.—*N. Mussinii*, 1 foot, is a compactly spreading greyish-leaved

labiate, with lavender-blue flowers, and is sometimes used for bedding or for marginal lines in large compound beds.

Nierembergia.—*N. rivularis*, 4 inches, from La Plata, has slender creeping rooting stems, bearing stalked ovate leaves, and large funnel-shaped white flowers, with a remarkably long slender tube; especially adapted for rock-work, requiring moist sandy loam.

Oenothera.—The genus of the Evening Primrose, consisting of showy onagrads, all of which grow and blossom freely in rich deep soils. *O. missouriensis* (macrocarpa), 6 to 12 inches, has stout trailing branches, lance-shaped leaves, and large yellow blossoms; *O. taraxacifolia*, 6 to 12 inches, has a stout crown from which the trailing branches spring out, and these bear very large white flowers changing to delicate rose; this perishes in cold soils, and should therefore be raised from seed annually. Of erect habit are *O. speciosa*, 1 to 2 feet, with large white flowers; *O. fruticosa*, 2 to 3 feet, with abundant yellow flowers; and *O. serotina*, 2 feet, also bright yellow.



FIG. 102.—*Phlox nivalis*.

Omphalodes.—Elegant dwarf borageworts. *O. verna*, 4 to 6 inches, a creeping shade-loving plant, has bright blue flowers in the very early spring; *O. Lucilia*, 6 inches, has much larger lilac-blue flowers, and is an exquisite rock plant for warm sheltered spots. Light sandy soil.

Onosma.—*O. taurica*, 6 to 8 inches, is a charming boraginaceous plant, from the Caucasus, producing hispid leaves, and cymose heads of drooping tubular yellow flowers. It is of evergreen habit, and requires a warm position on the rockwork, and well-drained sandy soil; or a duplicate should be sheltered during winter in a cold dry frame.

Ourisia.—Handsome scrophulariaceous plants, from Chili, thriving in moist well-drained peaty soil, and in moderate shade. *O. coccinea*, 1 foot, has erect racemes of pendent crimson flowers.

Papaver.—The Poppy. Very showy plants, often of strong growth, and of easy culture in ordinary garden soil. *P. orientale*, 3 feet, has crimson-scarlet

flowers, 6 inches across, and the variety *bracteatum* closely resembles it, but has leafy bracts just beneath the blossom. *P. alpinum*, 6 inches, white with yellow centre; *P. nudicaule*, 1 foot, yellow, scented, and *P. pilosum*, 1 to 2 feet, deep orange, are ornamental smaller kinds.

Pentstemon.—The popular garden varieties have sprung from *P. Hartwegii*. Other distinct kinds are *P. campanulatus*, 1½ feet, pale rose, of bushy habit; *P. humilis*, 9 inches, bright blue; *P. speciosus*, *cyranthus*, and *Jaffrayanus*, 2 to 3 feet, all bright blue; *P. barbatus*, 3 to 4 feet, scarlet, in long terminal panicles; *P. Murryanus*, 6 feet, with scarlet flowers and connate leaves; and *P. Palmeri*, 3 to 4 feet, with large wide-tubed rose-coloured flowers.

Phloxis.—Bold and showy labiates, growing in ordinary soil. *P. Russelliana* (*lunariifolia*), 4 feet, yellow, and *P. tuberosa*, 3 feet, purplish-rose, both with downy hoary leaves, come in well in broad flower borders.

Phlox nivalis and its allies are pretty trailing matted evergreen rock-plants, having the prostrate stems thickly set with awl-shaped leaves, and producing profuse clusters of salver-shaped flowers. *P. nivalis* (fig. 102) has white, *P. setacea* pale pink, and *P. subulata* deeper pink flowers, produced about May. There are some interesting hybrids of this group, of which *P. Nelsoni*, white with pink eye, is an example. The showy garden *Phloxes* have sprung from other types.

Physostegia.—Tall autumn-blooming labiates, of easy growth in ordinary garden soils. *P. imbricata*, 5 to 6 feet, has pale purple flowers in closely imbricated spikes.

Polemonium.—Pretty border flowers. *P. cœruleum* (Jacob's Ladder), 2 feet, has elegant pinnate leaves, and long panicles of blue rotate flowers. The variety called *variegatum* has very elegantly marked leaves, and is sometimes used as a margin or otherwise in bedding arrangements. Good garden soil. •

Polygonatum.—Elegant liliaceous plants, with rhizomatous stems. *P. multiflorum* (Solomon's Seal), 2 to 3 feet, with arching stems, and drooping white flowers from the leaf axils, is a handsome border plant, doing especially well in partial shade amongst shrubs, and also well adapted for pot culture for early forcing. Good garden soil.

Polygonum.—A large family, varying much in character, often weedy, but of easy culture in ordinary soil. *P. vacciniifolium*, 6 to 10 inches, is a pretty prostrate subshrubby species, with handsome rose-pink flowers, suitable for rockwork, and preferring boggy soil; *P. affine* (*Brunonis*), 1 foot, deep rose, is a showy border plant, flowering in the late summer; *P. cuspidatum*, 8 to 10 feet, is a grand object for planting where a screen is desired, as it suckers abundantly, and its tall spotted stems and handsome cordate leaves have quite a noble appearance.

Primula.—Beautiful and popular spring flowers, of which many forms are highly esteemed in most gardens. *P. vulgaris*, 6 inches, affords numerous handsome single and double-flowered varieties, with various-coloured flowers for the spring flower beds and borders. Besides this, *P. Sieboldii* *cortusoides amœna* (fig. 103), 1 foot, originally deep rose with white eye, but now including many distinct varieties of colour, such as white, pink, lilac, and purple; *P. japonica* (fig. 104), 1 to 2 feet, crimson-rose; *P. denticulata*, 1 foot, bright bluish-lilac, with its allies *P. erosa* and *P. purpurea*, all best grown in a cold frame; *P. viscosa*, 6 inches, purple, and its white variety *nivalis*, with *P. pedemontana* and *P. spectabilis*, 6 inches, both purple; and the charming little Indian *P. rosea*, 3 to 6 inches, bright cherry rose colour, are but a few of the many beautiful kinds in cultivation.

Pulmonaria.—Handsome dwarf borageworts, requiring good deep garden soil. *P. officinalis*, 1 foot, has prettily mottled leaves and blue flowers; *P. sibirica* is similar in character, but has broader leaves more distinctly mottled with white.

Pyrethrum.—Composite plants of various character, but of easy culture, *P. Parthenium eximium*, 2 feet, is a handsome double white form of ornamental character for the mixed border; *P. uliginosum*, 5 to 6 feet, has fine large white radiate flowers, in October; *P. Tchihatchewii*, a close-growing dense evergreen creening species, with long-stalked white flower-heads, is adapted for covering slopes in lieu of turf, and for rockwork.

Ranondia.—*R. pyrenaica*, 3 to 6 inches, is a pretty dwarf plant, requiring a warm position on the rockwork, and a moist peaty soil more or less gritty; it has rosettes of ovate spreading root-leaves, and large purple yellow-centred rotate flowers, solitary or two to three together, on naked stalks.



FIG. 103.—*Primula Sieboldii* (*cortusoides amœna*).

Ranunculus.—The florists' ranunculus is *R. asiaticus*. *R. amplexicaulis*, 1 foot, white; *R. aconitifolius*, 1 to 2 feet, white, with its double variety *R. aconitifolius flore-pleno* (Fair Maids of France); and *R. acris flore-pleno* (Bachelor's Buttons), 2 feet, golden yellow, are pretty. Of dwarfier interesting plants there are *R. alpestris*, 4 inches, white; *R. gramineus*, 6 to 10 inches, yellow; *R. parnassifolius*, 6 inches, white; and *R. rutæfolius*, 4 to 6 inches, white with orange centre. Good loamy garden soil.

Rudbeckia.—Bold-habited composite plants, well suited for shrubbery borders, and thriving in light loamy soil. The flower-heads have a dark-coloured elevated disk. *R. Drummondii*, 2 to 3 feet, with the ray-florets reflexed, yellow at the tip and purplish-brown towards the base; *R. fulgida*, 2 feet, golden yellow with dark chocolate disk, the flower-heads 2 to 3 inches across; and *R. speciosa*, 2 to 3 feet, orange-yellow with blackish-purple disk, the flower-heads 3 to 4 inches across, are showy plants.

Salvia.—The Sage, a large genus of labiates, often very handsome, but sometimes too tender for English winters. *S. Sciares*, 5 to 6 feet, is a very striking plant little more than a biennial, with branched panicles of bluish flowers issuing from rosy-coloured bracts; *S. patens*, 2 feet, which is intense azure, has tuberous roots, and may be taken up, stored away, and replanted in spring like a dahlia. *S. pratensis*, 2 feet, blue, a showy native species, is quite hardy; the variety *lupinoides* has the centre of the lower lip white.

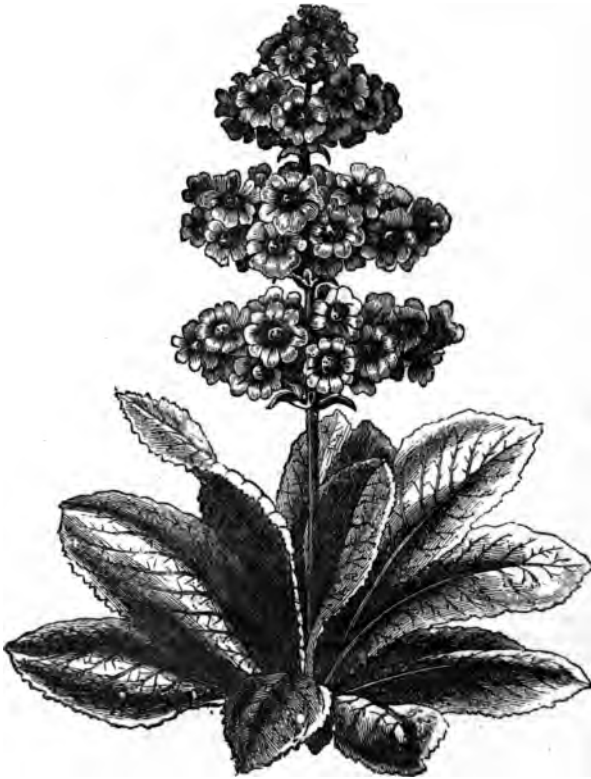


FIG. 104.—*Primula japonica*.

Saxifraga.—A very large genus, comprising plants of varied aspect, many of them handsome though simple in character, and most of them adapted for rockwork, requiring only ordinary good soil. Some of the larger growing species, now often called *Megasea*, are grand early-flowering border plants

with broad leaves and large cymose clusters of rosy-pink flowers, *e.g.*, *S. purpurascens*, *S. cordifolia*, and *S. crassifolia*, with their varieties. Of another group with silvery leaves there are representatives in *S. longifolia*, *S. casia*, *S. Cotyledon*, *S. pectinata*, and *S. Rochelliana*; of the green mossy group in *S. hypnoides*, *S. ceratophylla*, *S. muscoides*, &c.; and of the London Pride section in *S. umbrosa*, *S. Andrewsii*, *S. Geum*, and *S. Bucklandii*. *S. oppositifolia*, 2 to 3 inches, purple or white, is a brilliant plant for rockwork, forming a carpet over the surface of the stones.

Scilla.—Beautiful dwarf bulbous plants, thriving in well-worked sandy loam, or sandy peat. *S. bifolia*, 3 inches, and *S. sibirica*, 4 inches, both intense blue, are among the most charming of early spring flowers; *S. patula*, 6 to 8 inches, and *S. campanulata*, 1 foot, with star-shaped greyish-blue flowers, freely produced, are fine border plants, as is the later blooming *S. peruviana*, 6 to 8 inches, dark blue or white.

Sedum.—Pretty succulent plants of easy growth, and mostly suitable for rockwork. They are numerous, varied in the colour of both leaves and foliage, and mostly of compact tufted growth. *S. spectabile*, 1 to 1½ feet, pink, in great cymose heads, is a fine plant for the borders, and worthy also of pot-culture for greenhouse decoration. Mention may also be made of the common *S. acre* (Stonecrop), 3 inches, yellow, and its variety with yellow-tipped leaves.

Sempervivum.—Houseleek. Neat-growing succulent plants, forming rosettes of fleshy leaves close to the ground, and rapidly increasing by runner-like offsets; they are well adapted for rockwork, and do best in sandy soil. The flowers are stellate, cymose, on stems rising from the heart of the leafy rosettes. *S. arachnoideum*, purplish, *S. arenarium*, yellow, *S. globiferum*, and *S. Lageri*, rose, grow when in flower 3 to 6 inches high; *S. calcareum*, rose colour, and *S. Boutignianum*, pale rose, both have glaucous leaves tipped with purple; *S. Heuffeli*, yellow, with deep chocolate leaves, and *S. Wulfeni*, sulphur-yellow, are from 8 to 12 inches high.

Silene.—Pretty caryophyllaceous plants, preferring sandy loam, and well adapted for rockwork. *S. alpestris*, 6 inches, white, and *S. quadridentata*, 4 inches, white, are beautiful tufted plants for rockwork or the front parts of borders; *S. maritima flore-pleno*, 6 inches, white, *S. Elizabethæ*, 4 inches, bright rose, and *S. Schafta*, 6 inches, purplish-rose, are also good kinds.

Sisyrinchium.—Pretty dwarf iridaceous plants, thriving in peaty soil. *S. grandiflorum*, 10 inches, deep purple or white, blooms about April, and is a fine plant for pot-culture in cold frames.

Soldanella.—Charming dwarf primulaceous alpine from the Swiss mountains; the most familiar is *S. alpina* (fig. 105), which has dark green orbicular leaves growing in tufts, and about April produces flower-scapes 3 inches high, having funnel-shaped drooping blue flowers, prettily fringed at the margin. *S. pusilla* and *S. minima* are similar in character.

Spiræa.—Vigorous growing plants of great beauty, preferring good deep rather moist soil; the flowers small but very abundant, in large corymbose or spicate panicles. *S. Aruncus*, 4 feet, white; *S. astilboides*, 2 feet, white; *S. Filipendula flore-pleno*, 1½ feet, and *S. Ulmaria flore-pleno*, 3 feet, both white; *S. palmata*, 2 feet, rosy-crimson; and *S. venusta*, 3 feet, carmine rose, are some of the best.

Statice.—Pretty plants with broad radical leaves, and a much-branched inflorescence of numerous small flowers. *S. latifolia*, 2 feet, greyish-blue; *S. tatarica*, 1 foot, lavender-pink; *S. speciosa*, 1½ feet, rose colour; and *S. eximia*, 1½ feet, rosy-lilac—are good border plants. *S. bellidifolia*, 9 inches,

lavender; *S. emarginata*, 6 inches, purple; *S. globularisifolia*, 9 inches, white; and *S. nana*, 4 inches—are good sorts for the rockery.

Stenactis.—*S. speciosa*, 1 to 2 feet, is a showy composite, of easy culture in good garden soil; it produces large corymbs of flower-heads, with numerous narrow blue ray-florets surrounding the yellow disk.

Stipa.—*S. pennata* (Feather Grass), 1½ feet, is a very graceful-habited grass, with stiff slender erect leaves, and long feathery awns to the flowers.

Stokesia.—*S. cyanea*, 2 feet, is a grand autumn-flowering composite plant, with blue flower-heads, 4 inches across. Sandy loam and warm situation.

Symphytum.—Rather coarse-growing but showy boraginaceous plants, succeeding in ordinary soil. *S. caucasicum*, 2 feet, with blue flowers changing to red, is one of the finer kinds for early summer blooming.

Thalictrum.—Free-growing but rather weedy ranunculaceous plants, in many cases having elegantly cut foliage. *T. aquilegifolium*, 2 feet, purplish from the conspicuous stamens, the leaves glaucous, is a good border plant;



FIG. 105.—*Soldanella alpina*.

and *T. minus* has foliage somewhat resembling that of the Maidenhair fern. Ordinary garden soil.

Triteleia.—Charming spring-flowering bulbs, thriving in any good sandy soil. *T. Murrayana*, 8 inches, lavender-blue, and *T. uniflora*, 6 inches, white, are both pretty plants of the easiest culture, either for borders or rockeries.

Tritoma.—Splendid stoutish-growing plants of noble aspect, familiarly known as the Poker plant, from their erect rigid spikes of flame-coloured flowers; sometimes called *Kniphofia*. *T. Uvaria*, 3 to 4 feet, bright orange-red, passing to yellow in the lower flowers, is a fine autumnal decorative plant. They should be protected from frosts by a covering of ashes over the crown during winter.

Trollius.—Showy ranunculaceous plants, of free growth, flowering about May and June. *T. asiaticus*, 18 inches, deep yellow, globular; *T. europæus*, 2 feet, lemon yellow; and *T. napellifolius*, 2 to 2½ feet, golden yellow are all fine showy kinds. Rich and rather moist soil.

Tulipa.—Splendid dwarfish bulbs, thriving in deep sandy well-enriched garden soil, and increased by offsets. They bloom during the spring and early summer months. *T. Gesneriana*, the parent of the florists' tulip, 12 to 18 inches, crimson and other colours; *T. Eichleri*, 1 foot, crimson with dark spot; *T. Greigi* (fig. 106), 1 foot, orange with dark spot edged with yellow, and having dark-spotted leaves; *T. oculus solis*, 1 foot, scarlet with black centre; and *T. sylvestris*, 12 to 18 inches, bright yellow, are showy kinds.



FIG. 106.—*Tulipa Greigi*.

Verbascum.—Showy border flowers of erect spire-like habit, of the easiest culture. *V. Chaixii*, 4 to 5 feet, yellow, in large pyramidal panicles; *V. phoeniceum*, 3 feet, rich purple or white; and *V. formosum*, 6 feet, golden yellow in dense panicles, are desirable species.

Veronica.—The Speedwell family, containing many ornamental members; all the hardy species are of the easiest cultivation in ordinary garden soil. The rotate flowers are in close erect spikes, sometimes branched. *V. crassifolia*, 2 feet, dark blue; *V. incarnata*, 1½ feet, flesh-colour; *V. corymbosa*, 1½ feet, pale blue in corymbosely-arranged racemes; *V. gentianoides*, 2 feet, grey with blue streaks; and *V. virginica*, 5 feet, white, are distinct.

Vinca.—Periwinkle. Pretty rock plants, growing freely in ordinary soil. *V. herbacea*, of creeping habit, with purplish-blue flowers; *V. minor*, of trailing habit, blue; and *V. major*, 1 to 2 feet high, also trailing, are suitable for the rock garden. The last two are evergreen, and afford varieties which differ in the colour of their flowers, while some are single and others double.

Viola.—Violet. Charming dwarf plants, mostly evergreen and of tufted habit, requiring well-worked rich sandy soil. *V. calcarata*, 6 inches, light blue; *V. cornuta*, 6 to 8 inches, blue; *V. lutea*, 4 inches, yellow; *V. altaica*, 6 inches, yellow or violet with yellow eye; *V. palmaensis*, 6 to 8 inches, lavender-blue; *V. pedata*, 6 inches, pale blue; and *V. odorata*, the Sweet Violet, in its many single and double flowered varieties, are all desirable.

Fucaa.—Noble subarborescent liliaceous plants, which should be grown in every garden. They do well in light well-drained soils, and have a close family resemblance, the inflorescence being a panicle of white drooping tulip-shaped flowers, and the foliage rosulate, sword-shaped, and spear-pointed. Of the more shrubby-habited sorts *Y. gloriosa*, *recurvifolia*, and *Treculeana*, are good and distinct; and of the dwarfer and more herbaceous sorts *Y. angustifolia*, *flaccida*, and *flamentosa* are distinct and interesting kinds, the last two flowering annually.

The taste for cultivating the class of plants of which the foregoing list embraces some of the more prominent members is increasing, and our gardens will benefit by its extension; but we may hope that the folly of limiting the interest of the flower garden to this class of subjects alone, to the exclusion of the brilliant bedding flowers which have been evolved out of less showy materials by the gardener's skill, as some writers seem to desire, may never be realized.

We now proceed to notice at greater length the more important plants of this class,—those to which horticulturists have devoted the greatest attention, with the result, in many cases, of largely increasing the varieties of these “florists’ flowers.”

The *Anemone* (*Anemone coronaria*, fig. 107), often called the Poppy Anemone, is a tuberous-rooted plant, with parsley-like divided leaves, and large showy poppy-like blossoms on stalks of from 6 to 9 inches high; the flowers are of various colours, but the principal are scarlet, crimson, blue, purple, and white. There are also double-flowered varieties, in which the stamens in the centre are replaced by a tuft of narrow petals. It is an old garden favourite, and of the double forms there are named varieties. They grow best in a loamy soil, enriched with well-rotted manure, which should be dug in below the tubers. These may be planted in October, and for succession in January, the autumn planted ones being protected by a covering of leaves or short stable litter. They will flower in May and June, and when the leaves have ripened should be taken up and stored in a dry room till planting time. Anemones are easily raised from seed,

and a bed of the single varieties is a valuable addition to a flower-garden, as it affords, in a warm situation, an abundance of handsome and often brilliant spring flowers, almost as early as the snow-drop or crocus. The genus contains many other lovely spring blooming plants, of which *A. hortensis* and *A. fulgens* have less divided leaves and splendid rosy-purple or scarlet flowers; they require similar treatment. Another set is represented by *A. Pulsa-*



FIG. 107.—*Anemone coronaria*, single and double.

tilla, the Pasque-flower, whose violet blossoms have the outer surface hairy; these prefer a calcareous soil. The splendid *A. japonica*, and its white variety called *Honorine Jobert* (fig. 108) the latter especially, are amongst the finest of autumn blooming hardy perennials; they grow well in light soil, and reach 2½ to 3 feet in height, blooming continually for several weeks. A group of dwarf species, represented by the native British *A. nemorosa* and *A.*

apennina, are amongst the most beautiful of spring flowers for planting in woods and shady places.



FIG. 108.—*Anemone japonica* Honorine Jobert.

The *Antirrhinum* (*Antirrhinum majus*) is very easily managed. Sown in heat, and forwarded until the general time for planting out, it becomes a summer annual, and may be so treated; but under a slower and more hardy regime it may be sown in boxes in August, and pricked off into other boxes and wintered in a frame, for, though not often destroyed, it sometimes suffers greatly in a severe season. So treated, and planted out in well-prepared beds of good friable garden soil, it will become very showy and effective, and if a good strain of seed has been obtained many very beautiful kinds may generally be selected from the progeny. The named sorts are propagated by cuttings, and wintered in a frame. Some of the double-flowered varieties are interesting. There are forms with white, yellow, rose, crimson, magenta, and variously mottled and striped flowers, some of them of great beauty.

The *Auricula* (*Primula Auricula*), a native of the Alps, has been

an inmate of British gardens for about three hundred years, and is still prized by florists as one of their choicest flowers. The auricula loves a cool soil and shady situation. The florists' varieties are grown in rich composts, for the preparation of which numberless receipts have been given; but many of the old nostrums are now exploded, and a more rational treatment has taken their place. Thus Mr Douglas, the most recent authority, writes (*Hardy Florists' Flowers*):—

"There is no mystery, as some suppose, about the potting, any more than there is about the potting material. The compost should consist of turfy loam four parts, leaf-mould one part, sharp river or silver sand one part, and a few bits of broken charcoal mixed with it. The pots to be used should be from 3 to 4½ inches in diameter, inside measure; about 1 inch of potsherds should be placed in the bottom of each pot, and over this some fibrous turf, from which the fine particles of earth have been removed. The old soil should be shaken from the roots of the plants to be potted; and before potting cut off, if necessary, a portion of the main root. In potting press the soil rather firmly around the roots."

Auriculas are best grown in a cold frame mounted on legs about 2 feet from the ground, and provided with hinged sashes. A graduated stage formed of wood battens 6 inches broad, with a rise of 2 inches, should be fixed so as to take each one row of pots, with the plants standing at about 15 inches from the glass; the spaces between the shelves should be closed, while the top board of the back and the front should be hinged so as to be let down when desired for ventilation, the sashes, too, being movable for the same purpose, and also to afford facilities for examining and attending to the plants. This frame should face the north, and stand under shelter of a wall or hedge. No protection will be needed except in very severe frosts, when two or three thicknesses of garden mats may be thrown over the glass, and allowed to remain on until the soil is thawed, should it become frozen.

Auriculas may be propagated from seed, which is to be sown as soon as ripe, in July or August, in boxes, kept under cover, and exposed only to the rays of the morning sun. When seed has been saved from the finer sorts, the operation is one of considerable nicety, as it not unfrequently happens that the best seedlings are at first exceedingly weak. They generally flower in the second or third year, a few good sorts being all that can be expected from a large sowing. The established varieties are increased by taking off the offshoots, an operation which is performed at the time of potting in July or the beginning of August.

The original of the auricula is a hardy perennial herb, of dwarf

habit, bearing dull yellowish blossoms. This and the commoner forms raised from seed, as well as one or two double forms, are interesting hardy border flowers. The choice florists' varieties are divided into five classes:—the *green-edged*, with the margins of the flowers green; the *grey-edged*, with the green margins powdered with meal so as to appear to be coloured grey; the *white-edged*, with the mealy powder so dense as to cover the green; the *sells*, which have none of the green variegation of margin seen in the foregoing, but are of some distinct colour, as purple, maroon, &c., but have, like the preceding, a white paste surrounding the eye; and the *alpines*, which resemble the *sells* in not having any green marginal variegation, but differ in having a yellow centre more or less dense. The individual flowers of the first three groups of florists' auriculas show four distinct circles:—first the eye or tube, which should have the stamens lying in it, but sometimes has the pin-headed stigma instead, which is a defect; second, the paste or circle of pure white surrounding the eye; third, the body colour, a circle of some dark tint, as maroon or violet, which feathers out more or less towards the edge, but is the more perfect the less it is so feathered, and is quite faulty if it breaks through to the outer edge; fourth, the margin, which is green or grey or white. These circles should be about equal in width and clearly defined, and the nearer they are to this standard the more perfect is the flower. In the group of *sells* the conditions are the same, except that there is no margin, and consequently the body colour, which should be uniform in tone, extends to the edge. In the *alpines* there should be no paste or white surrounding the eye, but this space should be either golden-yellow or creamy-yellow, which makes two subdivisions in this group; and the body colour is more or less distinctly shaded, the edges being of a paler hue. There is besides another group yet in its infancy, the laced *alpines*, in which a distinct and regular border of colour surrounds each of the marginal lobes.

The following is a small selection of good sorts now obtainable:—

Green-edged.—Leigh's Col. Taylor, Booth's Freedom, Litton's Imperator, Ashton's Prince of Wales, Trail's Prince of Greens, Page's Champion, Beeston's Apollo, Trail's Anna.

Grey-edged.—Headly's George Lightbody, Lancashire's Lancashire Hero, Sykes's Complete, Kay's Alexander Melkielejohn, Walker's George Levick, Headly's C. E. Brown, Cunningham's John Waterston.

White-edged.—Heap's Smiling Beauty, Hepworth's True Briton, Ashworth's Regular, Taylor's Glory, Summerscale's Catherina, Lee's Bright Venus, Walker's John Simonite, Smith's Anne Smith.

Selfs.—Netherwood's Othello, Campbell's Pizarro, Spalding's Blackbird Pohlman's Garibaldi, Turner's C. J. Perry, Lightbody's Meteor Flag.

Alpines.—Turner's John Leech, Turner's Bessie Ray, Gorton's Diadem, Turner's A. F. Barron, Turner's Jessie, Turner's Susie Matthams.

The *Carnation* (*Dianthus Caryophyllus*), a native, as some suppose, of Italy, but occasionally found in an apparently wild state in England, has long been held in high estimation as a garden flower, not only for the beauty but for the delightful fragrance of its blossoms. The varieties are numerous, and are ranged under three groups, called *bizarres*, *flakes*, and *sels*. The *Picotees*, from their distinctness of character, are now looked upon as if they were a different plant, whereas they are only a seminal divergence from the carnation, but their numbers and variety, which are entirely owing to the assiduous endeavours of the modern florist to vary and to improve them, have amply justified their separation.

The true carnations, as distinguished from picotees, are those which have the colours arranged in longitudinal stripes or bars of variable width on each petal, the ground colour being white. The *bizarres* are those in which stripes of two distinct colours occur on the white ground, and it is on the purity of the white ground and the clearness and evenness of the striping that the technical merit of each variety rests. There are scarlet *bizarres* marked with scarlet and maroon, crimson *bizarres* marked with crimson and purple, and pink and purple *bizarres* marked with those two colours. The *flakes* are those which have stripes of only one colour on the white ground, and here we have purple flakes striped with purple, scarlet flakes striped with scarlet, and rose flakes striped with rose colour. There are still the *sels*, or those showing one colour only, as white, crimson, purple, &c., and these are commonly called *cloves*.

The *Picotee* differs from the carnation in having the petals laced instead of striped with a distinct colour; the subgroups bear the designations red-edged, purple-edged, rose-edged, and scarlet-edged, all having white grounds; each group divides into two sections, the heavy-edged and the light-edged respectively. In the heavy-edged sorts the colour appears to be laid on in little touches, passing from the edge inwards, but so closely that they coalesce into one line of colour from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch broad, and more or less feathered on the inner edge, the less feathered the better; while the light-edged sorts display only a fine edge, commonly called a wire edge, of colour on the white ground. To these have to be added yellow picotees, a group of great beauty, but as yet deficient in correctness of marking.

Even the choice varieties of the carnation or picotee may be very successfully grown in most unfavourable localities ; but the commoner sorts, such as may be raised freely from seed, on account of their robust constitution, are perhaps to be preferred for the ordinary flower garden ; while the single-flowered sorts are by no means to be despised, especially those having decided colours. It is by selecting the best seedlings that new varieties of merit are produced. The established varieties are propagated by layers or by pipings, the former plan being adopted with healthy plants in an ordinarily congenial season. The latter is sometimes had recourse to when the plants do not produce young shoots of sufficient length to admit of their being layered; and the cuttings, planted under close glasses in a bed where there is a very slight bottom heat, will generally root. Layering is, however, a more expeditious mode. It is performed at the time the plants are in flower, or as soon after as possible. The rooted layers may be removed and potted or planted out towards the end of September, or early in October, the choice sorts being potted in rather small pots and kept in a cold frame during winter, at which season the great enemy to be guarded against is damp.

The soil for carnations and picotees should be a good turfy loam, free from wireworm, and as fibry as it can be obtained ; to four parts of this add one part of rotten manure and one of leaf-mould, with sufficient sharp sand to keep it loose. A moderate addition of old lime rubbish, if attainable, will also be an advantage. This should be laid up in a dry place, and frequently turned over with the fork or spade, so as to be in a free friable condition for use towards the end of February or early in March. As to the size of the blooming pots, Mr Douglas observes :—

"I do not care to use them larger than 10 inches in diameter, inside measure, and three plants may be put into a pot that size ; a 9-inch pot may be used for a pair of a strong-growing sort, while weaker growers may be potted two in an 8-inch or even a 7-inch pot. If it is intended to propagate all the layers produced, that must be taken into account, as the plants will not have so good a chance in a small as in a large pot. After potting they should be kept in a well-ventilated frame until established, and set in the open air in an open sunny spot when the weather becomes genial, the flowering stems being tied up carefully as they grow up. At the flowering season they should be put in a thoroughly ventilated glass house, where they can be shaded from bright sunshine, or under the protection of a canvas screen to keep off rain and sun. Where there is any tendency in the flowers to burst the calyx on one side, the other divisions should be slit down a little, and the calyx should have a ligature, not too tight, of thread or matting ; this, if done early, will prevent the petals falling aside and destroying the symmetry of the flower."

The groups are so numerous that to name a selection of the best sorts would occupy too much space. Ample information on this head may be obtained from Mr Douglas's book already referred to (*Hardy Florists' Flowers*); and critically descriptive lists of all the varieties then grown, by the highest authority, Mr E. S. Dodwell, will be found in the volumes of the *Florist and Pomologist* for 1876 and 1877.

The *Chrysanthemum* (*Chrysanthemum sinense*) is one of the most popular of autumn flowers. It is a native of China, whence it was long since introduced. The small-flowered pompons, and the grotesque-flowered Japanese sorts are of more recent date, the former having originated from the Chusan daisy, a variety introduced by Mr Fortune in 1846, and the latter having also been introduced by the same traveller about 1862. The plants may be increased by division, in March or April, the divided portions being planted in beds of rich soil, under the shelter of a wall or fence, as a safeguard against cold and stormy weather. The shoots should be thinned out to about four or six from each root, and these should be staked as they grow up. They look extremely well in such a border, if arranged in two or three rows according to their heights, and with a judicious intermixture of colours, the advantage of growing them in this way being that a canvas screen can be put over them, by which means they flower in greater perfection, and last longer. They are of the easiest culture, even in town gardens.

The chrysanthemum is, however, of very great importance as a greenhouse plant for autumn and winter flowering, and for this purpose, as well as for exhibition culture, it is generally raised from cuttings, or suckers, which are taken off by some growers about October, and planted singly in 3-inch pots, the plants being wintered in cold frames, and shifted into larger-sized pots about March; they are topped when about 6 inches high, and the young shoots thus induced are again topped when 3 or 4 inches long. Others take short cuttings in March, and strike them quickly in a mild hotbed, airing freely as soon as rooted, and shifting and stopping as in the other case. As soon as fine weather sets in in June, the plants, having received one or two previous shifts according to the size which they are required to reach, should be plunged outdoors in a tolerably open spot, and there carefully watered and syringed. About the middle of July they should be shifted into their blooming pots, the pompons requiring a less size than the large-flowered and Japanese sorts, and after the end of July it is not advisable to con-

tinue the topping—technically “stopping”—of the young shoots, as it may interfere with the blooming. As soon as the flower-buds become visible, the plants are benefited by a watering of weak liquid manure two or three times a week. The pots should still be plunged in a bed of coal ashes or cocoa-nut refuse, till about the end of September, when they should be put under glass as a precaution against injury from autumn frosts, having, however, full ventilation by day. Abundant root watering is necessary until the flowers are developed, when the supply may be slightly diminished, and the atmosphere should be kept dryish by abundant ventilation. The compost used for potting in all the stages after the cuttings, for which any light earth will suffice, should consist of four parts loam to one of rotten dung and one of leaf-mould, giving rather more leaf-mould and less manure for the first potting, and rather more manure for the last; a little coarsely-pounded gritty matter may be added advantageously. For the large-flowered sorts 11-inch pots are large enough to produce very handsome specimens, and 8-inch pots suffice for the pompons, but very useful plants may be had in smaller pots than these. For fine specimen flowers only a single shoot is allowed to grow up, and this goes on unstopped, and finally develops two or three very large flowers; these latter require disbudding, as some sorts give the best flowers from the terminal buds, others from the side buds. The aphid or green fly is a great enemy to the plants, and must be kept under; dusting the hearts of the shoots with tobacco powder is a safe and efficient remedy; but, whatever be the method employed, it should be applied before the blossoms open.

The following are a few of the best varieties in each section:—

Large-flowered.—Abbé Passaglia, Alfred Salter, Beethoven, Beverley, Dr Brock, Emily Dale, Empress of India, George Glenny, Golden Beverley, Jardin des Plantes, Lady Hardinge, Mrs George Rundle, Mrs Heale, Prince Alfred, Prince of Wales, Princess of Wales, Venus, White Globe. These are all incurved flowers. To them might be added, for their merit as conservatory specimen plants, Chevalier Domage, Crimson Velvet, Julie Lagravere, and Mrs Forsyth.

Japanese.—Elaine, Fair Maid of Guernsey, James Salter, and Wizard, early sorts; Dr Masters, Fulton, Grandiflora, Hero of Magdala, Meg Merrilees, Purpleum album, Red Dragon, and The Dalmio, later sorts.

Anemone-flowered.—Acquisition, Empress, Fleur de Marie, Gluck, King of Anemones, Lady Margaret, Louis Bonamy, Miss Margaret, Miss Pethers, Prince of Anemones, Princess Louise, Sunflower.

Pompon.—Adonis, Andromeda, Brilliant, General Canrobert, Mille, Martha, Modèle, St Michael, Salamon. To these may be added of Anemone-flowered pompons—Antonius, Astrea, Calliope, Cedo Nulli (four colours), Firefly, Jean Hachette, Madame Montels, Marie Stuart, Miss Nightingale, Mr Ast e, Perle, Rose Marguerite, Virginale.

Within the last few years a new race of dwarf-growing early-blooming varieties has sprung up, and these are now increasing in number. They come into flower in August and September, and are extremely useful for filling up exhausted beds in the flower garden as well as for cutting. They are cultivated exactly as the others. The following are useful sorts of this group:—*Adrastus*, *Chromatella*, *Delphine Caboche*, *Frédéric Pelé*, *Madame Alphonse Dufoy*, *Madame Picoul*, *Precocité*, *Scarlet Gem*, *Souvenir d'un Ami*.

The *Crocus* sets our gardens aglow with its bright colours almost as soon as winter has departed. These crocuses of the flower garden are mostly seminal varieties of *C. vernus* and *C. aureus*, the former yielding the purple and striped, and the latter the yellow varieties. The headquarters of the genus is in Eastern Europe and Asia Minor, but *C. vernus* is found wild in some parts of England. It has been much improved by Dutch florists, and large quantities are annually imported from Holland. The crocus succeeds in any fairly good garden soil, and is usually planted near the edges of beds or borders in the flower garden, or in broadish patches at intervals along the mixed borders. The roots or corms should be planted 3 inches below the surface, and as they become crowded they should be taken up and replanted with a refreshment of the soil, at least every five or six years. Crocuses have also a pleasing effect when dotted about on the lawns and grassy banks of the pleasure ground. Some of the best of the varieties are:—

Purple: *David Rizzio*, *Sir J. Franklin*. *Shaded light blue*: *Lilaceus superbus*. *Blue tipped with white*: *Ne plus ultra*. *Striped*: *Albion*, *La Majestueuse*, *Sir Walter Scott*, *Cloth of Silver*. *White*: *Caroline Chisholm*. *Yellow*: *Large Dutch*, *Cloth of Gold*.

The species of *Crocus* are not very readily obtainable, but those who make a speciality of hardy bulbs ought certainly to search them out and grow them. They require the same culture as the more familiar garden varieties; but, as some of them are apt to suffer from excess of moisture, it is advisable to plant them in prepared soil in a raised pit, where they are brought nearer to the eye, and where they can be sheltered when necessary by glazed sashes,—which, however, should not be kept closed except when the plants are at rest. The autumn-blooming kinds include many plants of very great beauty.

Of the spring-flowering species, there are *C. aureus*, *susianus*, *stellaris*, *sulphureus*, *chrysanthus*, *mesiacus*, *Olivieri*, and *vitellinus*, having yellow flowers of various shades; *C. vernus*, *etruscus*, *Imperati*, *minimus*, *suaveolens*, and *veluchensis*, with blue or lilac flowers; *C. albiflorus*, *Fleischerianus*, *versicolor*, *strictus*, and *biflorus*, with white or whitish flowers. Of the autumn-blooming species, there are *C. speciosus*, *Clusianus*, *medius*, *Orpha-*

nidula, *longiflora* (*odora*), *Pallasii*, *Thomasii*, *Salzmanniana*, *nudiflora*, *autumnalis*, *serotina*, *Sieberi*, *Cartwrightiana*, and *byzantina*, with lilac or purple flowers; *C. Boryana*, *vallicola*, *hadriaticus*, *cancellatus*, and *Cambesiana*, with white or whitish flowers; and *C. Scharojani* with flowers of a rich saffron yellow.

The *Crown Imperial* (*Fritillaria imperialis*, fig. 109) grows up to a height of about 3 feet, the lower part of the stoutish stem being furnished with leaves, while near the top is developed a coronal of large pendent flowers surmounted by a tuft of bright green leaves like those of the lower part of the stem, only smaller. The flowers are bell-shaped, yellow or red, and in some of the forms double. The plant grows freely in good garden soil, preferring a deep well-drained loam, and is all the better for a top-dressing of manure as it approaches the flowering stage. Strong clumps of five or six roots of one kind have a very fine effect. It is a very suitable subject for the back row in mixed flower borders, or for recesses in the front part of shrubby borders. It flowers in April or early in May. There are a few named varieties, but the most generally grown are the single and double yellow, and the single and double red, the single red having also two prettily variegated varieties, in which the leaves are striped respectively with bands of white and yellow.



Fig. 109.—*Fritillaria imperialis*.

The *Dahlia* of the florist (*Dahlia variabilis*) yields two groups or varieties, which are known as show and fancy dahlias,—the former consisting of all self-coloured flowers and those light-ground ones which are edged, tipped, or laced with a dark colour; the latter, all flowers with the colour in stripes like a carnation, and all darker-ground flowers tipped with white. Besides these there are bedding dahlias, which are dwarf-growing sorts with decided colours, much used in flower-gardens where large effects are required to be produced; and pompon dahlias, which are very symmetrical small-flowered sorts, better adapted for cutting than the more bulky flowers

of the show varieties. The single-flowered *D. coccinea*, a most brilliant and highly effective ornamental plant, with some other allied kinds, has recently attracted much attention, and can be commended as an admirable half-hardy border flower, and well adapted for cutting to fill large vases. It is rather more delicate than the forms of *D. variabilis*, and the tuberous roots are very apt to be lost during winter, but it is readily raised from seeds, and if sown early flowers the same season. The varieties of the florists' dahlia selected for the flower garden should be those only which are of effective colours, whether selfs or others, and such as throw out their flower heads on long stalks clear of the foliage. The same remark applies to the pompons.

New varieties are procured from seed, which should be sown in pots or pans towards the end of March, and placed in a hotbed or propagating pit, the young plants being pricked off into pots or boxes, and gradually hardened off for planting out in June; they will flower the same season if the summer is a genial one. The older varieties are propagated by dividing the large tuberous roots, in doing which care must be taken to leave an eye to each portion of tuber, otherwise it will not grow. Rare varieties are sometimes grafted on the roots of others (see fig. 57, p. 132). The best and most general mode of propagation is by cuttings, to obtain which the old tubers are placed in heat in February, and as the young shoots, which rise freely from them, attain the height of 3 inches, they are taken off with a heel, and planted singly in small pots filled with fine sandy soil, and plunged in a moderate heat. They root speedily, and are then transferred to larger pots of light rich soil, and their growth encouraged until the planting-out season arrives, which is about the middle of June.

Dahlias succeed best in an open situation, and in rich deep loam, but there is scarcely any garden soil in which they will not thrive, if it is manured. For the production of fine showy flowers the ground must be deeply trenched, and well manured annually. The branches as well as the blossoms require a considerable but judicious amount of thinning; they also need shading in some cases, and individual protection from rain and wind. They may stand singly like common border flowers, but have the most imposing appearance when seen in masses arranged according to their height. Florists usually devote a plot of ground to them, and plant them in lines 5 to 10 feet apart. This is done about the beginning of June, sheltering them if necessary from late frosts by inverted pots or in some other

convenient way. Old roots often throw up a multitude of stems, which render thinning necessary. As the plants increase in height, they are furnished with strong stakes, to secure them from high winds. Dahlias flower on till they are interrupted by frost in autumn. The roots are then taken up, dried, and stored in a cellar or shed where they may be secure from frost and damp.

The *Delphinium*, or Bee-Larkspur, is so called from the resemblance of the petals in the original species, *D. elatum*, to the hairy body of a bee. The original had comparatively small flowers, but by hybridizing they have been very much increased in size, and improved in quality, and now constitute one of the brightest ornaments of the mixed border, or the shrubby group, often throwing up secondary blooming stems, especially if the first are removed in good time, instead of being allowed to form seeds. The colour varies from reddish-blue to pale blue or grey, but the prevailing one is dark blue. *Delphiniums* need a good rich soil, that of a loamy character being the best. They must be replanted at least every second year, and the soil either renewed or well manured and thoroughly broken up. Replanting may be done equally well early in autumn or when growth recommences in spring. The commoner single varieties, such as the brilliant *D. formosum*, may be reproduced with but slight variation from seed, but the double ones must be propagated by division. Unless sown as soon as ripe the seed is apt to take long to vegetate. If novelties are required, the flowers can be cross-fertilized. For mere propagation the best method is division; for this purpose the stems should be cut down early, say in July, the offsets when ready potted into small pots of light soil, and wintered in a frame. The plants should be well exposed to the sun, but sheltered from strong winds, and promptly and carefully staked. In a mixed border they should be planted in one of the back rows; but their spire-like inflorescence is very effective when they are planted several together in a group or bed in the front part of the shrubby border. They vary in height from 3 to 6 feet. The following are some of the best modern varieties :—

Single-flowered.—*Amabilis*, *Belladonna*, *Celestial*, *Gloire de St Mandé*, *Madame Chaté*, *Madame Henri Jacotot*, *Mrs Gerard Leigh*.

Double-flowered.—*Barlowi*, *Clair Courant*, *grandiflorum plenum*, *Keteleeri*, *Manteau de Minerva*, *Roi Léopold*, *Pompon Brilliant*, *Mrs J. Helme*.

The *Gladiolus* (fig. 110) has become one of our most popular flowers, and is a striking ornament of our gardens during the late summer months. The modern race of flowers has sprung from *G.*

gandavensis, but others are grown to a smaller extent, and come in at an earlier season. *G. cardinalis*, *cruentus*, and *floribundus* belong to this latter series, and are pretty subjects for the mixed borders, while for beds *G. brenchleyensis*, one of the early hybrids, is still one of the most brilliant and effective, the flowers being of a glowing scarlet. The choicer kinds afford a variety of colours, including white, yellow, blush, rose, salmon, cerise, scarlet, crimson, and rosy-purple, many of them being prettily striped or blotched. Being tall (3 to 4 feet), and spare of leaves, they are most effective when planted in beds furnished below with some bushy foliage plants, between which their spikes of brilliant flowers may appear; or they may be planted in the mixed border, where clumps of half a dozen roots of one kind have a much finer appearance than when they are dotted about singly.

A deep sandy loam is the best soil for the gladiolus, and this should be trenched up in October and enriched with well-decomposed manure, consisting partly of cow dung, the manure being disposed altogether below the bulbs, a layer at the bottom of the upper trench, say 9 inches from the surface, and another layer at double that depth. The



FIG. 110.—Gladiolus.

bulbs (technically, corms) should be planted in succession at intervals of two or three weeks through the months of March, April, and May. They should be planted about 3 inches deep, a little pure soil or sand being laid over each before the earth is closed in about them, an arrangement which may be advantageously followed with bulbous plants generally. In hot summer weather they should have a good mulching of half-rotten manure, and, as soon as the flower spikes are produced, liquid manure may occasionally be given them with advantage.

The gladiolus is easily raised from seeds, which should be sown in March, in pots of rich soil placed in heat, the pots being kept near the glass after they begin to grow, and the plants being gradually hardened to permit their being placed out-of-doors in a sheltered spot for the summer. In October they will have ripened off, and must be taken out of the soil, and stored in paper bags in a dry room secure from frost. They will have made little bulbs from the size of a hazel nut downwards, according to their vigour. In the spring they should be planted like the old bulbs, and the larger ones will flower during the season, while the smaller ones must be again harvested and planted out as before.

The following are good varieties of their respective colours, but new varieties are continually appearing, which have at least the merit of constitutional vigour :—

Crimson, Scarlet, Red, &c.—Horace Vernet, John Waterer, Lord Br'dport, Victory, Virgil, Lord Napier, Hesperia, Magnificent, Astrea, Lycoris, Addison, Meyerbeer.

Rose, Salmon, &c.—Figaro, Mons. Legouve, Sappho, Madame Furtado Oberon, Grandeur, Ulysse, Milton, Ninon de l'Enclos, Sir Joseph Paxton.

Purple.—Antiope, Eugène Scribe, Robert Fortune, Lacépède, Thomas Methven, Madame Vilmorin, La Favorite, Mozart.

White ground.—Accius, Mrs Reynolds Hole, Reine Blanche, Canova, Hogarth, Osci, Didon, Norma, Sylphide, Madame Adèle Souchet, Berthe Rabourdin.

Yellow.—Citrinus, Nestor, Yellow King, Ophir, Croesus, Pactolo.

The *Hollyhock* (*Althæa rosea*), one of the most stately of our garden flowers, is a native of the Levant, but has been very greatly improved in the hands of the florist, and the finer double kinds are much varied in colour and very handsome. It is a perennial, but often a short-lived one, and is not to be had in perfection unless a supply of young plants is raised annually. It requires an abundance of manure and a deep well-worked soil, which should be fully exposed to the winter's frost before planting. The plants of choice varieties are struck from eyes in autumn and potted, and kept in

cold frames through the winter, being planted out towards the end of April, early-rooted spring cuttings from strong pot plants preserved over winter in frames being planted about the same time and yielding an earlier bloom. As an ordinary border flower, the hollyhock may be raised from seed, good parents producing good offspring, and often reproducing the same colour with but little variation, unless they are cross-fertilized, when new varieties may be expected. The seeds may either be sown as soon as ripe in boxes kept under cover, or in the May following, and the young plants should after some few weeks probation to gain strength, be put out where they are to flower, and they will bloom well the following year. This is the best plan to adopt in gardens when exhibition flowers are not grown. Of late years the plant has suffered much from attacks of a parasitic fungus, *Puccinia malvacearum*, which is difficult to eradicate, though sometimes a strong solution of soft soap and sulphur, or of Gishurst compound, has been effectual in resisting its progress. The month of August is the ordinary blooming season.

The following are a few good sorts for a beginner:—Acme, Black Gem, Constance, Conquest, Edward Dean, Eleanor, Emperor, Fire King, Golden Drop, Incomparable, Jessie Dean, Joshua Clarke, Marvellous, Mr Chater, Octavia, Ruby Queen, Scarlet Gem, Tyrian Prince.

The *Hyacinth* (*Hyacinthus orientalis*), one of the most beautiful and fragrant of spring flowers, is a native of Levant, where it occurs abundantly, in form not unlike our common harebell. It has long been a favourite in the East; but it has been brought to its present artificial perfection in Holland, chiefly since the beginning of the last century, and the bulbs are annually imported from Haarlem and its vicinity in very large numbers.

The hyacinth delights in a rich light sandy soil. The Dutch incorporate freely with their naturally light soil a compost consisting of one-third coarse sea or river sand, one-third rotten cow dung without litter, and one-third leaf-mould. The soil thus renovated retains its qualities for six or seven years, but hyacinths are not planted upon the same place for two years successively, intermediary crops of narcissus, crocus, or tulips being taken. A good compost for hyacinths is sandy loam, decayed leaf-mould, rotten cow dung, and sharp sand in equal parts, the whole being collected and laid up in a heap and turned over occasionally. Well drained beds made up of this soil, and refreshed with a portion of new compost annually, would grow the hyacinth to perfection. The best time

to plant the bulbs is towards the end of October ; they should be arranged in rows, 8 inches asunder, there being four rows in each bed. The bulbs should be sunk about 3 or 4 inches deep, with a small quantity of clean sand placed below and around each of them. The beds should be covered with decayed tan-bark or cocoa-fibre, or half-rotten dung litter, and in severe weather with mats supported on hoops, which may be continued at night when the plants have grown up, but they should have full ex-

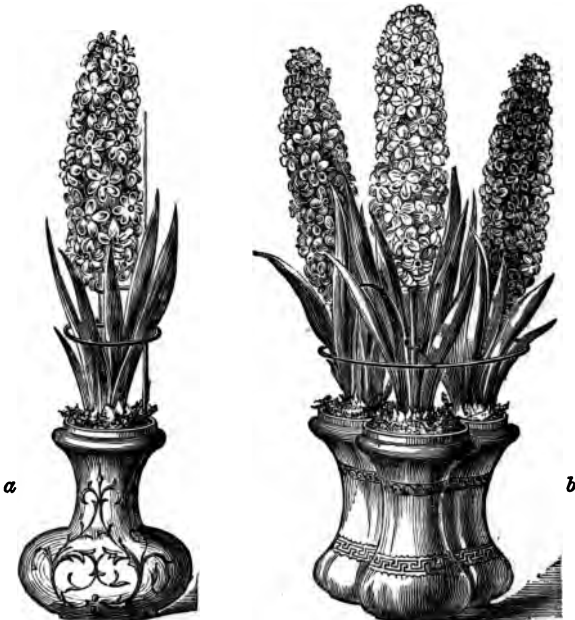


FIG. 111.—Hyacinth in glass (a); do. in triplet glass (b).

posure to daylight. As the flower-stems appear, they are tied to little rods to preserve them from accident. If the bulbs are at all prized, the stems should be broken off as soon as the flowering is over, so as not to exhaust the bulbs ; the leaves, however, must be allowed to grow on till matured, but as soon as they assume a yellow colour, the bulbs may be taken up, the leaves cut off near their base, and the bulbs laid out in a dry airy shady place to ripen, after which they are cleaned of loose earth and skin, ready for storing. It is the

practice in Holland, about a month after the bloom, or when the tips of the leaves assume a withered appearance, to take up the bulbs, and to lay them sideways on the ground, covering them with an inch or two of earth. About three weeks later they are again taken up and cleaned. In the store-room the roots should be kept dry, well-aired, and apart from each other.

Few plants are better adapted than the hyacinth for pot culture as greenhouse decorative plants; and by the aid of forcing they may be had in bloom as early as Christmas. They flower fairly well in 5-inch pots, the stronger bulbs in 6-inch pots. To be in bloom at Christmas, they should be potted early in September, in a compost resembling that already recommended for the open-air beds; and, to keep up a succession of bloom, others should be potted at intervals of a few weeks till the middle or end of November. The bulbs should be planted about level with the soil, and if a little sand is put immediately around them so much the better. The pots should be set in an open place on a dry hard bed of ashes, and be covered over to a depth of 6 or 8 inches with the same material; and when the roots are well developed, which will take from six to eight weeks, they may be removed to a frame, and gradually exposed to light, and then placed in a forcing pit in a heat of from 60° to 70°. When the flowers are fairly open, they may be removed to the greenhouse or conservatory.

The hyacinth may be very successfully grown in glasses (fig. 111 *a, b*) for ornament in dwelling houses. The glasses are filled to the neck with rain water, a few lumps of charcoal being dropped into them. The bulbs are placed in the hollow provided for them, so that their base just touches the water. This may be done in September or October. They are then set in a dark cupboard for a few weeks till roots are freely produced, and then gradually exposed to light in the living room.

There are both single and double-flowered varieties, but the single are generally preferred, as the bells are arranged more closely, so that



FIG. 112.—Roman Hyacinth.

they form a better spike than the doubles. A few good sorts are named below :—

Reds.—Of singles—Cavaignac, Lina, Macaulay, Norma, Sultan's Favourite, Von Schiller, Vuurbaak, Josephine, Fabiola, Robert Steiger, Madame Hodgson, Emmeline. Of doubles—Lord Wellington, Waterloo, Milton.

Blues.—Of singles—Argus, Charles Dickens, Grand Lilas, Haydn, Lord Palmerston, Orondates, Baron von Tuyl, Bleu Morant, Leonidas, General Havelock, Feruck Khan, Von Humboldt; the last three very dark. Of doubles—Laurens Koster, Van Speyk, Bloksberg.

Whites.—Of singles—Grand Vainqueur, Mont Blanc, Queen of the Netherlands, Grand Vedette, Madame Van der Hoop, La Franchise, La Grandesse, Elfrida (blush), Grandeur à Merveille (blush), Alba Maxima, Mirandoline, Queen Victoria. Of doubles—La Tour d'Auvergne, Prince of Waterloo, Jenny Lind.

Yellows.—Of singles—Ida, Bird of Paradise, Duc de Malakoff (striped with red). Of doubles—Jaune Suprême, Ophir d'Or, Ceresus.

To these may be added the early-flowering single white Roman hyacinth, (fig. 112), a small-growing pure white variety, remarkable for its fragrance, and well adapted for forcing, as it can be had in bloom if required by November. For windows it grows well in the small glasses commonly used for crocuses; and for decorative purposes should be planted about five bulbs in a 5-inch pot, or in pans holding a dozen each. If grown for cut flowers it can be planted thickly in boxes of any convenient size.

The *Iris* family includes a large number of kinds of various habit and character, all of them being plants of exceeding beauty, and remarkable for their brilliant colours, and for having the three outer segments of their flowers reflexed. There are two well-distinguished groups called the bulbous and the rhizomatous. The harder bulbous irises, including the Spanish iris (*I. Xiphium*), and the English iris (*I. xiphioides*), require to be planted in thoroughly drained beds in very light open soil, moderately enriched, and should have a rather sheltered position. Both these present a long series of beautiful varieties of the most diverse colours, flowering in June and July, the smaller Spanish iris being the earlier of the two. There are many other smaller species of bulbous iris. Being liable to perish from excess of moisture, they should have a well-drained bed of good but porous soil made up for them, in some sunny spot, and in winter should be protected by a 6-inch covering of half-decayed leaves or fresh cocoa-fibre refuse. To this set belong *I. persica*, *reticulata*, *filifolia*, *Histrio*, *junccea*, and others.

The herbaceous perennial irises, known commonly as the flag irises, are for the most part of the easiest culture; they grow in any good free garden soil, the smaller and more delicate species only needing the aid of turfy ingredients, either peaty or loamy, to keep it light and open in texture. The earliest to bloom are the forms of *Iris*

pumila, which blossom during March, April, and May, and are quite dwarf in habit. *I. susiana* and *I. iberica* (fig. 113) with singularly mottled flowers, also dwarf in habit, bloom in April and May; and during the latter month and the following one most of the larger species, such as *I. germanica*, *florentina*, *pallida*, *variegata*, *amœna*, *flavescens*, *sambucina*, *neglecta*, *ruthenica*, &c., produce their gorgeous flowers. Of many of the foregoing there are, besides the typical form, a considerable number of named garden varieties.

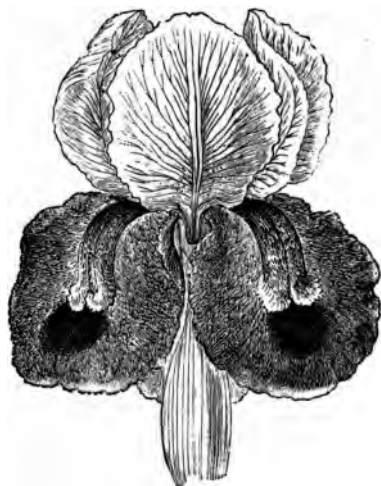


FIG. 113.—*Iris iberica*.

The beautiful Japanese *Iris Kämpferi* (fig. 114) is of comparatively modern introduction, and though of a distinct type is equally beautiful with the better known species. In their outer segments they are rather spreading than deflexed, forming an almost circular flower—quite so in some of the very remarkable duplex varieties, in which six of these broad segments are produced instead of three. Of this too there are numberless varieties cultivated under names. They require a sandy peat soil, on a cool moist subsoil.

The *Lily* (*Lilium*) is a very popular family of hardy bulbous flowers, and one which takes a high position in public estimation. The species are very handsome, and some of them have long been grown. They are so numerous and varied that no general cultural

instructions will be alike suitable to all. Some species, as *L. Martagon*, *candidum*, *chalcidonicum*, *Szovitzianum*, and others, will grow in almost any good garden soil, and succeed admirably in loam of a rather heavy character. *L. chalcidonicum* has an especial dislike to peat, which on the other hand suits the tiger lily (*L. tigrinum*) well, and is indispensable for the beautiful American



FIG. 114.—*Iris Kämpferi*.

L. superbum and *canadense*. The choice and more delicate species, such as the magnificent *L. auratum*, *speciosum*, and *Krameri*, which have come to us in comparatively recent times from Japan, the Californian *L. Humboldtii*, *pardalinum*, &c., and the splendid hybrid *L. Parkmanni*, are more particular as to soil, and require a deep bed of mixed turfy loam and peat, with plenty of sharp grit and a cool moist bottom. The margin of rhododendron beds, where

there are sheltered recesses amongst the plants, suit many of the more delicate species well, partial shade and shelter of some kind being essential. The bulbs should be planted about 6 inches below the surface, which should at once be mulched over with half-decayed leaves or cocoa-fibre to keep out frost.



FIG. 115.—*Lilium auratum* (plant).

Dr Wallace, who has paid much attention to the culture of these plants, remarks in his *Notes on Lilies*, that—

“Lilies require, so far as their roots are concerned, a cool bottom, abundant moisture, and for most kinds a free drainage.” He also recommends to “plant deeply, say 6 to 8 inches, so that the roots may easily get into a moist subsoil, and be sheltered from the scorching drying influence of the sun’s rays, to plant early in the autumn, so that the roots may be at work all the winter, and to plant in a cool shady border, not exhausted by the roots of trees, where the roots may always obtain moisture, and yet not be saturated.”

The noble *L. auratum* (figs. 115 and 116), with its large white

flowers, having a yellow band and numerous red or purple spots, is a magnificent plant when grown to perfection, and so are the



FIG. 116.—*Lillium auratum* (flower).

varieties called *rubro-vittatum* and *cruentum*, which have the central band crimson instead of yellow. Of *L. speciosum*, also Japanese,



FIG. 117.—*Lillium Szovitzianum* (*colchicum*).

the true typical form and the red-spotted and white varieties are grand plants for late summer blooming in the conservatory. The

tiger lily, *L. tigrinum*, and its varieties *Fortunei*, *splendidum*, and *flore-pleno*, are amongst the best species for the flower garden, *L. Thunbergianum* and its many varieties being also good border flowers. The pretty *L. Leichtlinii* and *colchicum* (= *Szovitzianum*, fig. 117), with drooping yellow flowers, and the scarlet drooping-flowered *L. tenuifolium* make up, with those already mentioned, a series of the finest hardy flowers of the summer garden. The Indian *L. giganteum* (fig. 118) is perfectly distinct in character, having broad heart-shaped leaves, and a noble stem 10 feet high, bearing a dozen



FIG. 118.—*Lillium giganteum*.

or more large deflexed, funnel-shaped, white, purple-stained flowers; and the Chinese *L. cordifolium* is similar in character, but dwarfer in habit.

For pot culture, the soil should consist of three parts turfy loam to one of leaf-mould and thoroughly rotted manure, adding enough pure grit to keep the mass porous. If leaf-mould is not at hand, turfy peat may be substituted for it. The plants should be potted in October. The pots should be plunged in a cold frame and protected from frost, and about May may be removed to a sheltered and moderately shady place out-doors to remain till they flower, when they may be

removed to the greenhouse. This treatment suits *L. auratum*, the splendid varieties of *L. speciosum*, and also the chaste-flowering trumpet-tubed *L. longiflorum*, and its varieties.

The *Lobelia* is familiar in gardens under two very different forms, that of the dwarf-tufted plants used for summer bedding, and that of the tall showy perennials. Of the former the best type is *L. Erinus*, growing from 4 to 6 inches high, with many slender stems, bearing through a long period a profusion of small but bright blue two-lipped flowers. That which is called *speciosa* offers the best strain of the dwarf lobelias, but the actual varieties are being constantly superseded by new sorts. A good variety will reproduce

itself sufficiently true from seed for ordinary flower borders, but for formal bedding arrangements it is necessary to secure exact uniformity by propagating from cuttings.

The herbaceous lobelias, of which *L. fulgens* may be taken as the type, may be called hardy except in so far as they suffer from damp in winter ; they throw up a series of short rosette-like suckers round the base of the old flowering stem, and these sometimes, despite all the care taken of them, rot off during winter. The roots should either be taken up in autumn, and planted closely side by side in boxes of dry coal ashes, these being set for the time they are dormant either in a cold frame or in any airy place in the greenhouse ; or they may be left in the ground, in which case a brick or two should be put beside the plants, some coal ashes being first placed round them, and slates to protect the plants being laid over the bricks, one end resting on the earth beyond. About February they should be placed in a warm pit, and after a few days shaken out and the suckers parted, and potted singly into small pots of light rich earth. After being kept in the forcing pit until well established, they should be removed to a more airy greenhouse pit, and eventually to a cold frame preparatory to planting out. They should have a loamy soil, well enriched with manure ; they require copious waterings when they start into free growth. These tall-growing lobelias make good pot plants, for which purpose the suckers should be parted and the strong ones only potted singly in autumn ; they should be placed in a warm pit to induce them to root freely, transferred when well established to an airy greenhouse shelf, and shifted on frequently during spring till they occupy pots a foot in diameter. The soil should be a very rich loam, top-dressing being given when they are coming into flower, and a very free supply of water is essential. They may be raised from seeds, which, being very fine, require to be sown carefully ; but they do not flower usually till the second year except they are sown very early in heat. A few good sorts are—*Carminata*, *Distinction*, *Excellent*, *Peach-blossom*, *Ruby*, and *Victoria Regina*.

The *Narcissus* is a garden flower of great beauty and considerable variety of form. The species, which are low bulbous plants and with few exceptions hardy, range in five well-marked sections.

The Hoop-petticoat *Narcissi*, sometimes separated as the genus *Corbularia*, are not more than from 3 to 6 inches in height, and possess grassy foliage and yellow or white flowers. These have the

coronet in the centre of the flower very large in proportion to the other parts, and much expanded, like the old hooped petticoats. The common hoop-petticoat, *N. Bulbocodium*, has comparatively large bright yellow flowers; *N. tenuifolius* is smaller and somewhat paler; *N. citrinus* is paler and larger; while *N. monophyllus* is white. The small bulbs should be taken up in autumn and replanted



FIG. 119.—*Narcissus Empress*.

in January or February, according to the state of the season. They bloom about March or April. The soil should be free and open, so that water may pass off readily.

A second group is that of the Pseudo-Narcissi, constituting the genus *Ajax* of some botanists, of which the daffodil, *N. Pseudo-Narcissus*, is the type. In this the corona is also very large and

prominent, but is more elongated and trumpet-shaped. Of this group the most striking species perhaps is *N. bicolor*, which has the perianth almost white, and the coronet deep yellow; it yields two fine varieties, *Horsfieldii* and *Empress* (fig. 119). *N. cernuus* (*moschatus*) and *N. cernuus plenus* are double and single forms of a cream-coloured species of great beauty; and besides these there are *N. lobularis*, *nobilis*, *obvallaris*, *Telamonius*, *maximus*, and others, amongst the most stately of the species, besides *N. minor* and *minimus*, which are miniature repetitions of the daffodil. All these grow well in good garden soil, and blossom from March onwards, coming in very early in genial seasons.

Another group, the Mock Narcissi, with coronets of medium size, includes the fine varieties of *N. incomparabilis*, one of which is known as butter-and-eggs, *N. poculiformis* (*montanus*), *N. odoratus* and *odorus minor* (Queen Ann's jonquil), *N. juncifolius*, and others. The hardier forms of this set thrive in the open border, but the smaller sorts, like Queen Ann's jonquil, are better taken up in autumn, and replanted in February; they bloom freely about April or May.

The Polyanthus Narcissi (fig. 120) form another well-marked group, whose peculiarity of producing many flowers on the stem is indicated by the name. In these the corona is small and shallow as compared with the perianth. Some of the hardier forms, as *N. Tazetta* itself, the type of the group, succeed in the open borders in light well-drained soil, but the bulbs should be deeply planted, not less than 6 or 8 inches below the surface, to escape risk of injury from frost. Many varieties of this form of narcissus are grown. They admit of being forced into early bloom, like the hyacinth and tulip. They vary with a white, cream, or yellow perianth, and a yellow, lemon, primrose, or white cup or coronet; and, being richly fragrant, they are general favourites amongst spring flowers. The jonquils, noticed above, as well as the double white narcissus, are also grown in pots for early flowering; and the polyanthus narcissi are sometimes used for bedding out in the spring garden. The following varieties are good:—*Bazelman major*, *Gloriosa*, *Sir Isaac Newton*, white with yellow cup; *Grand Monarque* and *White Pearl*, white with pale yellow cup; *Paper White*, pure white, early; *Bathurst*, *Perle d'Amour*, and *Sulphurine*, yellow with yellow or orange cup; and *Grand Primo*, a very fine yellow. These are planted or potted about October, and treated in the same way as the hyacinth.

There remains another little group, the Pheasant's-eye Narcissi (*N. poeticus*), in which the perianth is large, spreading, and conspicuous, and the coronet or cup very small and shallow. These pheasant's-eye narcissi, of which there are several species or well-marked varieties, as *N. radiiflorus*, *poetarum*, *recurvus*, &c., blossom in succession during April and May, and all do well in the



FIG. 120.—*Polyanthus Narcissus*.

open borders as permanent hardy bulbs. *N. biflorus*, the primrose peerless, a two-flowered whitish yellow-cupped species, is equally hardy and easy of culture ; *N. gracilis* is yellow-flowered and blooms later, as does the yellow-flowered *N. Jonquilla*, better known as the jonquil, of which there are single and double flowered varieties.

The *Paeony* is a remarkably showy plant, of which two very

distinct types occur in gardens :—one the stout-growing herbaceous perennials, with fleshy tuberiform roots and annual stems, which have sprung mainly from *Pæonia albiflora* and *P. officinalis* ; the other called the tree pæony, stiff growing plants with half-woody permanent stems, which have sprung from the Chinese *P. Moutan*.

The herbaceous pæonies usually grow from 2 to 3 feet in height, and have large much-divided leaves, the ample flowers of varied and attractive colours, being of globular form in the double varieties which are those most prized in gardens. They blossom about the mouths of May and June as well as later in the summer, and as ornaments for large beds in pleasure grounds, and for the front parts of shrubberies, few flowers equal them in gorgeous effect. A good loamy soil—rather light than heavy—suits them best, and a moderate supply of manure is beneficial. They are impatient of frequent transplantings or repeated divisions for purposes of propagation, but when necessary they may be multiplied by this means, care being taken that a sound bud is attached to each portion of the tuberous roots.

The older varieties of *P. albiflora* include *candida*, *festiva*, *fragrans*, *Humei*, *Pottsi*, *Reevesii*, *rubescens*, *vestalis*, *Whitleyi*, &c. ; those of *P. officinalis* embrace *albicans*, *anemoniflora*, *Baxteri*, *blanda*, *rosea*, *Sabini*, &c. The garden varieties of modern times are, however, still more beautiful, the flowers being in many instances delicately tinted with more than one colour, such as buff with bronzy centre, carmine with yellowish centre, rose with orange centre, white tinted with rose, &c. We name a selection of a few of the light and dark coloured sorts, the former including tinted whites and yellows, and the latter crimsons, roses, pinks, &c. :—

Light-coloured Varieties :—*Aurora*, *Boule de Neige*, *Candida Plena*, *Carnea plena*, *Chamois*, *Cleopatra*, *Delicata*, *Festiva Maxima*, *Impératrice Charlotte*, *Leonie*, *Madame Calot*, *Madame Villmorin*, *Magnifica*, *Marie Lemoine*, *Virginie*.

Dark-coloured Varieties :—*Ambroise Verschaffelt*, *Atrosanguinea*, *Bossuet*, *Dr Bretonneau*, *Gloire de Douai*, *Jeanne d'Arc*, *Madame Furtado*, *Modeste-Guérin*, *Mons. de Villeneuve*, *Oberlin*, *Prince Troubetzkoi*, *Purpurea Superba*, *Reine des Roses*, *Souvenir de l'Exposition Universelle*, *Surpasse Pottsi*, *Victoire d'Alma*.

The Siberian *P. tenuifolia*, with finely-cut leaves, and crimson flowers, is a graceful border plant, and its double-flowered variety is perhaps the most elegant of its race.

The Moutans or Tree Pæonies are remarkable for their subshrubby habit, forming vigorous plants sometimes attaining a height of 6 to 8 feet, and producing in April or May magnificent flowers which

vary in colour from white to lilac, purple, and rose. These are produced on the young shoots, which naturally bud forth early in the spring, and are in consequence liable, unless protected, to be cut off by spring frosts. They require to be thoroughly ripened in summer, and therefore a hot season and a dryish situation are desirable for their well-being; and they require perfect rest during winter. Small plants with a single stem, if well matured so as to ensure their blossoming, make very attractive plants when forced. They are increased by grafting in autumn on the roots of herbaceous pæonies.

Of the older varieties the most conspicuous is *P.M. papaverifolia*, while the following are more recent acquisition:—*Atrosanguinea*, *Globosa*, *Lilacina*, *Picta*, *Reevesiana*, *Salmonea*, and *Versicolor*. Other garden varieties are—*Gloria Belgarum*, *Alba Grandiflora*, *Emperor of China*, *Lactea*, *Ocellata*, *Purpurea*, *Atropurpurea*, *Rollissoni*, *Violacea Purpurea*, *Violacea Plena*, *Unicolor Purpurea*, *Beauty of Canton*, *Blanche de Noisette*, *Comte de Flandre*, *Elizabeth d'Italie*, *Hendersoni*, *Impératrice*, *Joséphine*, *Leopoldii*, *Madame Stuart Low*, *Mandarin*, *Professeur Morren*, *Robert Fortune*, *Triomphe de Gand*, and *Souvenir de Gand*.

The *Pansy*.—This popular flower, also called heartsease, has sprung from the native British *Viola tricolor*, which has probably been crossed with some of the allied species of this large and varied genus. The modern varieties of the pansy consist in the main of three types:—the show varieties; the fancy varieties, obtained a few years ago from Belgium, and now very much improved; and the bedding varieties, which are free-blooming sorts marked rather by effectiveness of colour in the mass than by quality in the individual flower. The latter are extremely useful in spring flower gardening.

The pansy flourishes in well enriched garden soil, in an open but cool situation, a loamy soil being preferable. Cow dung is the best manure. The established sorts are increased by cuttings, whilst seeds are sown to procure novelties. The cuttings, which should consist by preference of the smaller growths from the centre of the plant, may be planted early in September, in sandy soil, under a hand light or in boxes under glass, and as soon as rooted should be removed to a fresh bed of fine sandy soil. The seeds may be sown in August or September. The bed may be prepared early in September, to be in readiness for planting, by being well manured with cow dung and trenched up to a depth of 2 feet. The plants should be planted in rows at about a foot apart. In spring they should be mulched with half-rotten manure, and the shoots as they lengthen should be pegged down into this enriched surface to induce

the formation of new roots. If the blooms show signs of exhaustion by the inconstancy of their colour or marking, all the flowers should be picked off, and this top-dressing and pegging down process performed in a thorough manner, watering in dry weather, and keeping as cool as possible. Successional beds may be put in about February, the young plants being struck later, and wintered in cold frames. The fancy pansies require similar treatment, but are generally of a more vigorous constitution.

When grown in pots in a cold frame, about half a dozen shoots filling out a 6-inch pot, pansies are very handsome decorative objects. The cuttings should be struck early in August, and the plants shifted into their blooming pots by the middle of October; a rich open loamy compost is necessary to success, and they must be kept free of aphides. Both the potted plants and those grown in the open beds are benefited by the use of liquid manure.

The bedding pansies possess a dwarf compact free-branched habit of growth, which results in the production of a constant succession of flowers. They are a hardy race, flowering freely from the early spring onwards. These, with the varieties of *Viola lutea* and *Viola cornuta*, have latterly acquired great prominence from their utility in furnishing early flowers for the spring garden.

The *Pentstemon*.—Many species of *Pentstemon* have been introduced to our gardens, and rank amongst the finest of all the herbaceous perennials. The *pentstemon* of the florist (fig. 121) has, however, sprung from *P. Hartwegii*, a suffruticose species, which has been more or less hybridized with *P. gentianoides*, *P. Cobæa*, and possibly some others. The plants are not absolutely hardy, but endure English winters unharmed in favoured situations. They are freely multiplied by cuttings, selected from the young side shoots, planted early in September, and kept in a close cold frame or under a hand light till rooted. They should then be potted singly in small pots, and wintered in a cold frame, the pots being plunged in ashes or cocoa-nut refuse, in order to keep the soil from drying too rapidly, and to prevent the frost from injuring the young roots. To obtain strong plants, they should be shifted into 5-inch pots early in March, and kept growing in well-ventilated frames until May. They flower freely in July and August and onwards till cut down by frosts. Smaller plants may be had by leaving the cuttings in the cutting pot during the winter, and introducing them to the propagating pit in February or March, when their young

shoots can be taken off, struck, potted, and grown on in frames till about May. Seedlings, if raised in heat in February or early in March, and pricked out and forwarded under glass till May, will flower the same year, but probably not so early as those raised from cuttings.

The following are good kinds, and varied in colour and character, but new ones appear every season, and sometimes show a marked advance on the older sorts:—Andrew Hunter, Apollon, Countess of Eglington, Bon Villageois, Col. Long, The Bride, Dr St Paul, John F. Kinghorn, John M'Pherson, Lady Coutts Lindsay, Molière, Mrs A. Sturry, W. P. Laird, Le Khédive, Black Knight, Stanstead Rival, Souvenir de St Paul, Georges Sand.



FIG. 121.—Garden variety of *Pentstemon*.

The *Phlox*, with its modern improvements, constitutes one of the finest of hardy herbaceous plants. There are two types—the pyramidalis or early-flowering sorts, which appear to grow best in the northern districts, and the decussata or late-flowering sorts, which are taller and are those most frequently grown in English gardens. The early-flowering phloxes are increased by division of the root or by cuttings which may be obtained about the middle or end of March, and strike readily under a hand glass. They should be grown in beds, and will make good blooming plants for the

following year. The older or blooming plants should be grown in beds of deep rich loamy soil, mulched with half rotten dung as they come on towards flowering. They should have abundance of water in dry weather. It is not advisable to allow more than five stems to grow up to flower. The varieties of this section flower a month or six weeks earlier than those of the decussata group, and are at the height of their bloom in July.

A few good sorts are—Duchess of Athole, Lady Napier, Miss Robertson, Perfection, Waverley, Stella, Alexandra, Iona, Marquis, James Mitchell, Elvina, James Neilson, Miss Hunter, Bayard, Purple Emperor, Mauve Queen.

The late-flowering phloxes may be raised either from cuttings or by division. From cuttings in early spring vigorous young plants may be obtained which flower well the following season. By division of the older plants into separate rooted portions, plants are obtained which flower well the same year. The latter require a deeply trenched soil, thoroughly manured, and should be well watered in dry weather; indeed, as they grow up to bloom, manure water may be given judiciously with advantage.

A good selection of these are—A. F. Barron, Liervalli, Lothair, Roi des Roses, Lucien Tisserand, Madame la Comtesse de Turenne, Madame Domage, Menottil, Mons. H. Low, Coccinea, Mrs Laing, Rêve d'Or, Marie Saison, Madame Thibaut, Madame Rœmpler, Gloire de Neuilly, J. K. Lord, La Candeur, Mons. Malet, Chanzy, Queen of Whites.

The Picotee. See under *Carnation*.

The *Pink* of the garden has resulted from the cultivation and improvement of *Dianthus plumarius*. The pink is a great favourite with florists, those varieties being preferred which have the margin of the petals entire, and which are well marked in the centre with bright crimson or dark purple. Its grassy but glaucous foliage is much like that of the carnation, but the whole plant is smaller, and the greater portion of the colouring of the flowers forms a blotch near the base of the petal, instead of being laid on in stripes as in the carnation, or confined to the outer edge as in the picotee.

Pinks require a free loamy soil deeply trenched, and well enriched with cow dung. They are readily increased by pipings (fig. 60, *d*), taken off during the flowering period, and planted in light soil under a hand light, or in the open ground in a shady situation; they may be planted an inch apart in rows 2 or 3 inches asunder, and should be pressed firmly into the soil. When rooted, which will be about August, they should be planted 4 inches apart in a nursery bed, where they may remain till the latter part of September or the early part of October. The chief attention required during

winter is to press them down firmly should they become lifted by frosts, and in spring the ground should be frequently stirred and kept free from weeds. As the flowering stems grow up they should be supported by sticks, and when the buds appear they should be assisted to burst regularly by tying a soft ligature round them. The pink is also raised from seeds, not only to obtain new varieties, but to keep up a race of vigorous growing sorts. The seeds may be sown in March or April, in pots in a warm frame, and the young plants may be pricked off into boxes and sheltered in a cold frame. They should be planted out in the early part of the summer in nursery beds, in which, if they have space, they may remain to flower, or the alternate ones may be transplanted to a blooming bed in September or the early part of October; in either case they will bloom the following summer. These will grow in any good garden soil, but the richer it is the better.

There is also a number of varieties which are useful for forcing during the early spring months. These are propagated from early pipings, and grown in nursery beds, being taken up in October, and potted in a rich loamy compost, and wintered in a cold pit till required for the forcing house. The varieties named Anne Boleyn, Lady Blanche, Mrs Moore, Lord Lyons, Mrs Pettifer, Rubens, and Coccinea are good useful forcing sorts.

Of choice florists' varieties the number is not very large. The following would form a good selection:—Turner's Bolard, Dr Masters, Dr Maclean, Shirley Hibberd, Lord Kirkaldy, Godfrey, and Bertram; Maclean's Annie, Beauty, John Ball, and New Criterion; Marris's Excelsior and Vesta; Kirtland's Rev. G. Jeans; Bragg's Nonpareil and Goliath; and Hooper's Beauty of Bath.

The *Polyanthus* is one of the oldest of the florists' flowers, and is no doubt an umbellate form of the primrose, *Primula vulgaris*. For some time it has been held in little repute, but is now coming into greater favour, and novelties are being slowly produced. The florists' polyanthus has a golden margin, and is known as the gold-laced polyanthus, the properties being very distinctly laid down and rigidly adhered to. The chief of these are—a clear unshaded blackish or reddish ground colour, an even margin or lacing of yellow extending round each segment and cutting through its centre down to the ground colour, and a yellow band surrounding the tube of exactly the same hue as the yellow of the lacing. The plants are quite hardy, and grow best in strong loamy soil, tolerably well enriched with dung and leaf-mould; they should be planted about October. Plants for exhibition present a much better appearance

if kept during winter in a cold well-aired frame. Of these Cheshire Favourite, Earl of Lincoln, and Criterion, with black grounds, and Exile, Lancer, and Sunrise, with red grounds, are amongst the best.

For the flower borders what are called fancy polyanthuses are adopted. These are best raised annually from seed, the young crop each year blooming in succession. The seed should be sown as soon as ripe, the young plants being allowed to stand through the winter in the seed bed. In April or May they are planted out in a bed of rich garden soil, where they will bloom abundantly the following spring. A few of the better sorts should be allowed to ripen seed; the rest may be thrown away.

The *Potentilla*, as a speciality, is a flower of modern times. The double-flowered varieties are especially remarkable for their ornamental qualities. A soil of a good loamy staple, enriched with rotten dung, will grow the potentilla to perfection. They may be increased, though not very freely, by parting them into as many pieces as there are crowns, the side growths being those which can usually be thus separated. This may be done in autumn or spring, and the plants will generally bloom the following season. The plants like an open situation, and are well suited for filling a small or moderate-sized bed, as the foliage is of a neat and pleasing character when the plants are not in bloom.

The following are good named sorts:—Chromatella, Le Vésuve, Louis Van Houtte, Meteor, Pluton, Vulcan, Le Dante, Mars, Nigra, Caméléon, Fénelon, Etna.

The *Double Primrose* is closely allied to the polyanthus. There are some very handsome varieties grown, as the crimson, white, yellow, purple, blue, and others. These all succeed under the treatment given to the choicer kinds of polyanthus.

The *Pyrethrum* is quite a modern garden flower, extremely useful as blooming in the early summer months, and remarkable for its neat habit and the great variety of character and colour which it presents. The type forms are the *P. roseum* and *P. carneum* of botanists, hardy perennials, with finely cut leaves, and large flower-heads, having in the one case a ray of deep rose-coloured and in the other of flesh-coloured ligulate florets surrounding the centre or disk. They bloom during May and June, as well as later on, and are welcome ornaments for the flower borders, and for cutting.

The pyrethrum grows best in soil of a loamy texture; this should be well manured and deeply trenched up before planting, and should

be mulched in the spring by a surface dressing of half-decayed manure. The plants may be increased by division, the side shoots being taken off early in autumn with a portion of roots attached. They may be placed either in separate beds or in the mixed flower border as may be required. In beds they can be supplemented as the season passes on by the intermixture of later-blooming subjects, such as gladioli. Slugs are often destructive to the young shoots. Seeds should be sown in spring in a cold frame, and the young plants should be put out into beds when large enough, and should flower the following May.

The following will make a useful selection of sorts:—Aurora, Bonamy, Boule de Neige, Brilliant, Carminatum Plenum, Charles Baltet, Delicatum, Émile Lemoine, Floribundum Plenum, Gloire d'Italie, Hermann Stenger, Iveryanum, La Vestale, Le Dante, Madame Billiard, Minerva, Ne plus ultra, Prince of Wales, Solfaterre, Titienus.

The *Ranunculus* (*R. asiaticus*, fig. 122), a native of the Levant, is one of the older florists' flowers, which has sported into numberless varieties, but was formerly held in much greater esteem than it is at the present time. According to the canons of the florists, the flowers, to be perfect, should be of the form of two-thirds of a ball, the outline forming a perfect circle, with the centre close, the petals smooth-edged, the colour dense, and the marking uniform.

The ranunculus requires a strong and moist soil, with a fourth of rotten dung. The soil should be from 18 inches to 2 feet deep, and at about 5 inches below the surface there should be placed a stratum 6 or 8 inches thick of two-year-old rotten cow dung, mixed with earth, the earth above this stratum, where the roots are to be placed, being perfectly free from fresh dung. The tubers are planted in rows 5 or 6 inches apart, and 3 or 4 inches separate in the rows, the turban sorts in October, the more choice varieties in February. They should be so close that the foliage may cover the surface of the bed. The autumn planted roots must be sheltered from frost by old tan or sifted coal ashes. The plants when in flower should be covered with an awning; when the leaves wither, the roots are to be taken up, dried, and stored. The ranunculus is readily propagated from seed obtained from semidouble sorts, which are often of themselves very beautiful flowers. It is generally sown in boxes in autumn or spring. The young plants thus raised flower often in the second, and always in the third year.

The turban varieties, which are very showy for the borders, are of a few positive colours, as scarlet, yellow, brown, carmine, and

white. The florists' varieties have been bred from the Persian type, which is more delicate.

The following sorts may be taken as the foundation of a collection :—Apollo, Eliza, Marquis of Hertford, Helena, Interestor, Sincerity, Garibaldi, Enchanter, Flaminius, Coronation, Strephon, Melanchthon.



Fig. 122.—*Ranunculus*, varieties.

The *Tulip* (*Tulipa Gesneriana*) is a native of the East, whence it was introduced into Europe about the middle of the 16th century. About the year 1635 its culture was very engrossing ; and, indeed, the rage for possessing rare sorts had become so great in Holland as to give rise to a strange species of gambling, known to the collectors of literary and scientific anecdotes by the name of Tulipo-mania. At present, though not to be met with in every garden, the finer tulips have yet some ardent cultivators, while certain varieties, as the early Duc Van Thol and its allies, and the double tulips of the Tournesol type, are much used for general garden decoration, and for forcing. The latter, however, spring from other species of the genus.

The florists' varieties of tulips, which have sprung from *Tulipa Gesneriana*, are arranged in separate classes named *bizarres*, *byblœmens*, and *roses*, according to their colour and marking. Tulips are readily raised from seeds, and the seedlings when they first flower are of one colour,—that is, they are self-coloured. Judged by the florists' rules, they are either good or bad in form, and pure or stained (white or yellow) at the base; the badly formed and stained flowers are thrown away, while the good and pure are grown on, these being known as "breeder" tulips. The breeder bulbs and their offsets may grow on for years producing only self-coloured flowers, but after a time, which is varied and indefinite, some of the progeny "break," that is, produce flowers with the variegation which is so much prized. The flower is then said to be "rectified"; it is a *bizarre* when it has a yellow ground marked with purple or red, a *byblœmen* when it has a white ground marked with violet or purple, or a *rose* when it has a white ground marked with rose colour. One of the most important of the properties of a fine florists' tulip is that the cup should form, when expanded, from half to a third of a hollow ball, the divisions of the perianth being six in number, broad at the ends, and smooth at the edges, so that the divisions may scarcely show an indenture. Another is that the ground colour should be clear and distinct, whether white or yellow. The least stain at the base of the flower, technically called the "bottom," would render a florists' tulip utterly valueless. What are called feathered flowers are those which have an even close feathering, forming an unbroken edging of colour all round, flamed flowers being those which have a beam or bold mark down the centre, not reaching to the bottom of the cup. Some flowers are both feathered and flamed, and in all cases the colour must be uniformly distributed.

Tulips are usually grown in beds, which should be made up, to the depth of about 2 feet, with a rich compost of about four parts loam to one of leaf-mould and one of thoroughly decomposed manure, which should have been well mixed some time before required for use. The bottom of the bed must be thoroughly drained, and so arranged that the water may not only soak down to the bottom, but find egress there. New soil is not required every year, but it should be deeply turned up and laid in ridges, and every third year it should be renewed to about a foot in depth, and the new soil well mixed with the old. The bed should be in an open but sheltered position, and should be got ready in September or

early in October, the bulbs being planted in October or early in November, 6 inches apart, and 3 or 4 inches deep. The bed should be 4 feet wide—sufficient to take seven rows of bulbs, a little river sand being placed about each. An awning should be placed over the bed when the buds show colour, in order to lengthen the duration of the flowers, and removed when the flowers fade. After the flowers have fallen, the seed-vessels are broken off close by the stem, to prevent the plant from exhausting itself in perfecting seed, and to direct its energies to the forming of the new bulb, and when the leaves and stalks turn brown the bulbs are taken up and laid out for a few days in a cool airy place, when they should be stored in drawers till planting time, being occasionally examined in case any of them decay.

Tulips are readily propagated by offsets, which are taken off from the parent bulbs, and nursed in separate beds till they be full grown. New varieties are raised from seed, and are from five to seven years old before they flower.

The following are a good selection of show tulips:—

Bizarres.—*Feathered*: Demosthenes, Sir Joseph Paxton, Garibaldi, Commander, Sulphur, George Hayward. *Flamed*: Excelsior, Dr Hardy, Surpass Polyphemus, Masterpiece, Ajax, William Lea.

Byblæmens.—*Feathered*: William Bentley, Friar Tuck, David Jackson, Bessie, Mrs Cooper, Talisman. *Flamed*: Duchess of Sutherland, Nimbus, Talisman, Bacchus, Adonis, Carbuncle.

Roses.—*Feathered*: Charmer, Industry, Nanny Gibson, Lady Wilton, Mrs Lea, Madame St Arnaud. *Flamed*: Annie Macgregor, Lady Sefton, Mrs Barlow, Sarah Headly, Adair, Triomphe Royale.

For decorative purposes, as forcing and spring bedding, the following are some of the best sorts grown:—

Singles.—Canary Bird, Couleur Cardinal, Couronne Pourpre, Duc Van Thol, Duchesse de Parma, Kelzerskroon, Proserpine, Roi Pépin, Bride of Haarlem, Pottebakker, White Pottebakker, Thomas Moore, Vermillion Brilliant, Yellow Prince.

Doubles.—Couronne des Roses, Duke of York, Gloria Solis, Imperator Rubrorum, Mariage de ma Fille, Overwinnar, Rex Rubrorum, Tournesol, Yellow Tournesol, La Candeur.

HARDY TREES AND SHRUBS.

Much of the beauty of the pleasure garden depends upon the proper selection and disposition of ornamental trees and shrubs. It is to be regretted that this department of the garden is often greatly neglected, and the many ornamental subjects introduced during the last half century are too frequently overlooked by planters and garden artistes. We can only afford space here for lists of some of the better and more useful and ornamental trees and shrubs, and

may refer to *Thompson's Gardener's Assistant* for selections of the choicer species, accompanied by descriptive notes. We introduce here a sketch of the Knaphill Cyprus (*Cupressus Lawsoniana erecta*

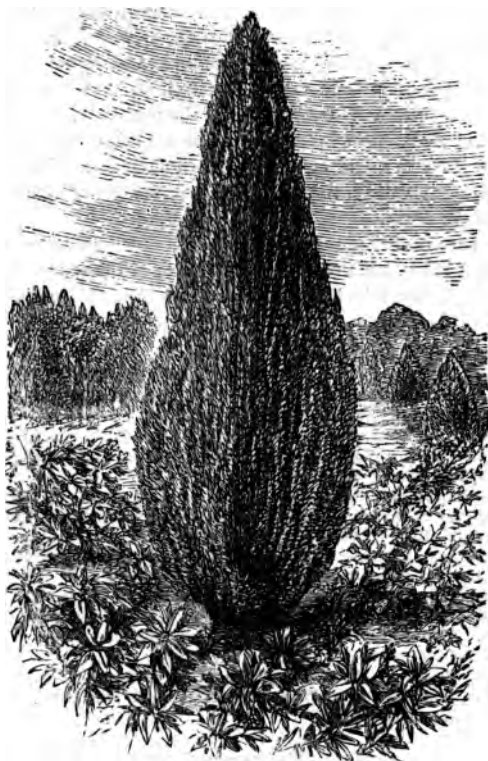


FIG. 123.—*Cupressus Lawsoniana erecta viridis*.

viridis, fig. 123) as that of the most refined and elegant both in form and colour of all our evergreens, and also one of the hardiest, being unaffected by the severest frosts.

The following list, which is not exhaustive, furnishes material from which a selection may be made to suit various soils and situations. The shrubs marked* are climbers.

Hardy Deciduous Trees.

Acer—Maple.	Laburnum.
Æsculus—Horse-Chestnut.	Larix—Larch.
Ailantus—Tree of Heaven.	Liriodendron—Tulip Tree.
Alnus—Alder.	Magnolia.
Amygdalus—Almond.	Morus—Mulberry.
Betula—Birch.	Negundo—Box-Elder.
Carpinus—Hornbeam.	Ostrya—Hop Hornbeam.
Carya—Hickory.	Paulownia.
Castanea—Chestnut.	Planera.
Catalpa.	Platanus—Plane.
Celtis—Nettle Tree.	Populus—Poplar.
Cerasus—Cherry.	Ptelea—Hop Tree.
Cercis—Judas Tree.	Pyrus—Pear, &c.
Cotoneaster.	Quercus—Oak.
Cratægus—Thorn.	Rhus—Sumach.
Diospyrus.	Robinia—Locust Tree.
Fagus—Beech.	Salix—Willow.
Fraxinus—Ash.	Sophora.
Ginkgo—Maldenhair Tree.	Taxodium—Deciduous Cypress.
Gleditschia—Honey Locust.	Tilia—Lime.
Gymnocladus—Kentucky Coffee Tree.	Ulmus—Elm.
Juglans—Walnut.	Virgilia.
Kölreuteria.	Xanthoceras.

Hardy Evergreen Trees.

Abies—Silver Fir.	Libocedrus.
Araucaria—Chili Pine.	Magnolia.
Arbutus—Strawberry Tree.	Picea—Spruce Fir.
Biota—Arbor Vita.	Pinus—Pine.
Buxus—Box.	Quercus—Oak.
Cedrus—Cedar.	Retinospora.
Cephalotaxus.	Scladopitys—Umbrella Pine
Cryptomeria—Japan Cedar.	Sequoia (Wellingtonia).
Cupressus—Cypress.	Taxus—Yew.
Ilex—Holly.	Thuopsis.
Juniperus—Juniper.	Thuja—Arbor Vita
Laurus—Bay Laurel.	Tsuga.

Hardy Deciduous Shrubs.

Abelia.	Calophaca.
Acer—Maple.	Calycanthus—Carolina Allspice.
Æsculus—Horse-Chestnut.	Caragana.
Amelanchier	Cerasus—Cherry.
Ampelopsis.*	Chimonanthus.
Amygdalopsis.	Clematis.*
Aralia.	Colutea—Bladder Senna.
Aristolochia.*	Cornus—Dogwood.
Berberis—Berberry.	Cotoneaster.
Bignonia *—Trumpet Flower.	Cratægus—Thorn.

Cydonia—Japan Quince.
 Cytisus—Broom, &c.
 Daphne.
 Deutzia.
 Edwardsia.
 Elaeagnus.
 Euonymus—Spindle Tree.
 Forsythia.*
 Fremontia.
 Genista.
 Halesia—Snowdrop Tree.
 Hamamelis—Wych Hazel.
 Hibiscus—Althæa frutex, &c.
 Hippophae—Sea Buckthorn.
 Hypericum—St John's Wort.
 Jasminum*—Jasmine.
 Kerria.
 Laurus—Laurel.
 Ligustrum—Privet.
 Lonicera*—Honeysuckle.

Lycium.*
 Magnolia.
 Menispermum*—Moonseed.
 Periploca.*
 Philadelphus—Mock Orange.
 Rhus—Wig Tree, &c.
 Ribes—Flowering Currant.
 Robinia—Rose Acacia, &c.
 Rosa—Rose.
 Rubus*—Bramble.
 Spartium—Spanish Broom.
 Spiræa.
 Staphylea—Bladder-Nut.
 Symphoricarpos—Snowberry.
 Syringa—Lilac.
 Tamarix—Tamarisk.
 Viburnum—Guelders Rose, &c.
 Vitis—Vine.
 Weigela.

Hardy Evergreen Shrubs.

Akebia.*
 Arbutus.
 Aucuba—Japan Laurel.
 Azara.
 Bambusa—Bamboo.
 Berberidopsis.*
 Berberis—Berberry.
 Buddleia.
 Bupleurum.
 Buxus—Box.
 Ceanothus.
 Cerasus—Cherry-Laurel, &c.
 Cistus—Sun-Rose.
 Cotoneaster.
 Crataegus—Thorn.
 Daphne.
 Desfontainia.
 Erica—Heath.
 Escallonia.
 Euonymus.
 Fabiana.
 Fatsia (Aralia).
 Garrya.
 Griselinia.
 Hedera*—Ivy.

Hypericum—St John's Wort.
 Ilex—Holly.
 Jasminum*—Jasmine.
 Kadsura.*
 Lardisabala.*
 Laurus—Sweet Bay.
 Ligustrum—Privet.
 Lonicera* | Honeysuckle.
 Magnolia.
 Osmanthus.
 Pernettya.
 Phillyrea.
 Photinia.
 Retinospora.*
 Rhamnus—Alaternus.
 Rhododendron—Rose-Day.
 Rosa*—Rose.
 Ruscus.
 Skimmia.
 Smilax.*
 Stauntonia.*
 Ulex—Furze.
 Viburnum—Laurustinus.
 Vinca—Periwinkle.
 Yucca—Adam's Needle.

The *Rhododendron*.—In places where the soil is suitable, the rhododendron, on account of its flowering qualities, is fast taking the place of the laurel in the mixed shrubbery. This plant, with

its associates the azalea, kalmia, andromeda, and the like, requires, generally speaking, a peaty soil, and a cool, rather moist situation ; but, though a peaty soil is preferable, especially for the choice kinds, it is not essential. When, however, the soil is loamy, it must have incorporated with it a liberal portion of leaf-mould and decayed manure, cow dung being preferable, and, if at all heavy, some clean road grit. The plants do not thrive in soil which contains calcareous matter.

These subjects, in view of the source of most of the originals, are commonly called American plants ; and a separate plot, called the American garden, is often set apart for them. For such a plot the catawbiense type of rhododendron is preferable, being hardier, producing better foliage, and comprising many of the finest flowering sorts. Such varieties as Sir Thomas Sebright, Old Port, Mrs Heneage, Michael Waterer, H. W. Sargent, Alexander Dancer, Brayanum, Scipio, Everestianum, Minnie, Mrs John Clutton, J. Marshall Brooks, Sigismund Rucker, Mrs Milner, and fastuosum flore-pleno, may be counted on as sterling sorts, which will always give satisfaction. The varieties of Azalea, though deciduous in habit, are desirable on account of their brilliant and effective colours, and with them may be associated such subjects as Andromeda, Cassandra, Leucothoe, Dabeocia, Daphne Cneorum, the hardy Heaths, Gaultheria, Kalmia, Ledum, Pernettya, Rhodora, Vaccinium, and Zenobia.

The *Rose*.—The rose is so universal a favourite that some portion of the garden must necessarily be devoted to it, if the situation be at all favourable. Roses will not, however, thrive in the vicinity of large towns, since they require a pure air, and do not endure a smoky atmosphere. The best soil for them is a deep rich strong loam free from stagnant moisture. Very light sandy or gravelly soils, or soils which are clayey and badly drained, are not suitable, and both must be greatly improved if rose-growing on them is attempted. Light soils would be improved by a dressing of strong loam in conjunction with cow dung or nightsoil ; the latter, provided it is properly prepared and not too fresh, is indeed the very best manure for roses in all but soils which are naturally very rich. Heavy soils are improved by adding burned earth or gritty refuse, with stable manure and leaf-mould or cocoa-fibre refuse ; and damp soils must necessarily be drained. Roses require a constant annual supply of manure, and, if this is given as a mulching in autumn, it serves to protect their roots through the winter. They also require liberal supplies of water

during the growing season, and especially to be kept clear of aphides and other insect pests, which may be done by dusting them with snuff while moist, and washing it off with the syringe next day, or by syringing with dilute tobacco water or some of the many insecticides now provided to facilitate this rather troublesome task.

Some growers prefer roses grown on their own roots, some on the Manetti, and others on the brier stock. There is this to be said in favour of their own roots that, if the tops are killed down by accident or by severe weather, the roots will usually throw up new shoots true to their kind, which cannot be looked for if they are worked, though it is sometimes recommended to plant deep in order that the rose itself may learn to do without its foster parent the stock. Too often, however, in the case of persons unfamiliar with roses, the choice rose dies, and the stock usurps its place.

An open situation, not shaded, but sheltered from strong winds, is what the rose prefers. October and November are the best months for planting the hardy kinds. The tender varieties are better laid in in a sheltered place, and the planting deferred till March or April. In regard to pruning, roses vary considerably, some requiring close cutting and others only thinning out; some again may be safely pruned in autumn, and others are better left till spring. Instructions on this point as to the several groups of varieties will be found in most rose catalogues.

Where dwarf beds of roses are required, a good plan is to peg down to within about 6 inches from the ground the strong one year old shoots from the root. In due time blooming shoots break out from nearly every eye, and masses of flowers are secured, while strong young shoots are thrown up from the centre, if the plant be on its own roots. During the winter the old shoots which have thus flowered and exhausted themselves are cut away, and three or four or more of the strongest and best ripened young shoots are reserved for pegging down the following season, which should be done about February. In the meantime, after the pruning has been effected, plenty of good manure should have been dug in about the roots. Thus treated, the plants never fail to produce plenty of strong wood for pegging down each succeeding season.

BEDDING PLANTS.

This term is chiefly applied to those summer-flowering plants, such as pelargoniums, petunias, dwarf lobelias, verbenas, &c., which are employed in masses for filling the beds of a geometrical parterre.

Of late years, however, more attention has been bestowed on arrangements of brilliant flowering plants with those of fine foliage, and the massing also of hardy early-blooming plants in parterre fashion has been very greatly extended. Bedding plants thrive best in maiden soil, and therefore the beds should be occasionally wholly or partly renovated with fresh earth. A light loam, liberally manured with thoroughly rotten dung from an old hotbed or thoroughly decomposed cow droppings and leaf-mould, forms the best kind of compost, but in the case of free-growing plants, like pelargoniums, over-richness must be avoided.

Spring Bedding.—For this description of bedding, hardy plants only must be used ; but even then the choice is tolerably extensive. For example, there are the Alyssums, of which *A. saxatile* and *A. gemonense* are in cultivation ; *Antennaria tomentosa* ; *Arabis alba* ; *Aubrietias*, of which the best sorts are *A. Campbelliæ* and *A. grandiflora* ; the double *Bellis perennis* or Daisy ; the Wallflowers, including *Cheiranthus Cheiri* (the Common Wallflower), *C. alpina*, and *C. Marshallii* ; *Hepaticas*, the principal of which are the varieties of *H. triloba*, and the blue *H. angulosa* ; *Iberis* or Candytuft ; *Lithospermum fruticosum* ; *Myosotis* or Forget-me-not, including *M. alpestris*, *M. dissitiflora*, *M. azorica*, and *M. sylvestris* ; *Phloxes*, like *P. subulata*, with its varieties *setacea*, *Nelsoni*, *nivalis* (fig. 102) ; the single-flowered varieties of the Primrose, *Primula vulgaris* ; *Pyrethrum Parthenium aureum*, called Golden Feather ; *Sempervivum calcareum* ; the pink-flowered *Silene pendula* ; self-coloured varieties of the Pansy, *V. tricolor*, and of *V. lutea* and *V. cornuta*, as well as some recent hybrids. Besides these there are the various spring-flowering bulbs, such as the varieties of *Hyacinthus*, *Tulipa*, *Narcissus*, *Fritillaria*, *Muscari* or Grape Hyacinth, *Crocus*, *Scilla*, and *Galanthus* or Snowdrop.

Summer Bedding.—There is great variety amongst the plants which are used for bedding out in the garden during the summer months, but we can note only some of the most important of them. Amongst them are the *Ageratums*, the old tall-growing sorts of which have been superseded by dwarfier varieties, as *Imperial Dwarf* and *Swanley Blue* ; *Alternantheras*, the principal of which are *A. amoena*, *amoena spectabilis*, *magnifica*, *paronychioides major aurea*, and *amabilis* ; *Alyssum maritimum variegatum* ; some of the named varieties of *Antirrhinum majus*, especially the dwarf varieties ; *Arundo Donax variegata* ; *Begonias* ; *Calceolarias* ; *Cannas* (fig. 124) ; *Centaurea ragusina* ; *Clematises*, of which the hybrids of the

Jackmanni type are best ; *Dahlia variabilis*, and the single-flowered forms of *D. coccinea* ; *Echeverias*, of which *E. secunda* and *E. metallica* are much employed ; *Gazanias* ; *Heliotropium peruvianum* ; *Iresine* ; the *Lantanas* ; *Lobelias* ; *Mesembryanthemum cordifolium variegatum* ; *Pelargoniums*, of which the various classes of zonal or bedding varieties are unapproachable for effect and general utility ; *Petunias* ; *Phloxes* ; *Polemonium cœruleum variegatum* ; *Pyrethrum Parthenium aureum*, especially useful as an edging to define the



FIG. 124.—The Canna in the flower garden.

outline of beds upon grass ; *Tropæolums*, especially some of the varieties of *T. Lobbianum* ; and *Verbenas*, the offspring of *Tweediana*, *chamædrifolia*, and others. Few bulbs come into the summer flower gardens, but amongst those which should always be well represented are the *Gladiolus*, the *Lilium*, and the *Tigridia*.

Subtropical Bedding.—A few years ago the late Mr John Gibson, then superintendent of Battersea Park, introduced the style of plant-

ing known as subtropical gardening, from the use that is made of subtropical plants. In the climate of London and the south and west of England this new feature proved very successful, but less so in the north of England and in Scotland, except in very favoured localities. These subtropical materials may be used either in masses of one kind, or in groups arranged for contrast, or as the centres of groups of less imposing or of dwarfier-flowering subjects ; or they may be planted as single specimens in appropriate open spaces, in recesses, or as distant striking objects terminating a vista. Some of the finest of these plants of bold and striking habit are found in



FIG. 125.—*Wigandia caracasana*.

the *Aralia* or *Fatsia*, the *Wigandia*, the *Montagnæa*, the *Uhdea*, and the *Ferdinanda*. *Aralia japonica* and *papyrifera* are very fine, and so are *Wigandia caracasana* (fig. 125) and *Vigieri*, *Montagnæa heracleifolia* (also known as *Polymnia grandis*), *Uhdea bipinnatifida*, and *Ferdinanda eminens*. *Ficus elastica* (fig. 126) is an effective subtropical plant if used large enough. Many palms, some tree ferns, and the noble *Musas*, especially *Musa Ensete*, do fairly well in sheltered situations. The *Cannas* afford great variety of size, form, and colour. The different forms of *Ricinus*, which are of the bolder type of subjects, the more elegant *Arundo Donax* and its variegated

variety, and the very graceful *Arundo conspicua* may also be named. *Arundinaria falcata* and other Bamboos, if grown in large pots or tubs and plunged in shady sheltered places during summer, give a striking tropical effect; and in warm situations some of these may be introduced as permanent plants. Of lesser subjects *Centaurea ragusina* and *gymnocarpa*, *Erythrina*s, *Funkias*, *Gunnera scabra*, and some of the *Solanums*, as *S. marginatum* and *robustum*, are all useful and effective; and many others might be added.

Carpet Bedding or *Mosaiculture* consists in covering the surface of a bed, or a series of beds forming a design, with close low-growing plants, in which cer-



FIG. 126.—*Ficus elastica* or India-rubber tree.

tain figures are brought out by means of plants of a different habit or having different-coloured leaves. Sometimes, in addition to the carpet or ground colour, individual plants of larger size and handsome appearance are dotted symmetrically over the beds, an arrangement which is very telling. Some of the best plants for carpeting the surface of the beds are—*Antennaria tomentosa*, white; *Sedum corsicum* and *glaucum*, grey; and *Sedum Lydium*, *Mentha Pulegium gibraltarium*, and *Herniaria glabra*, green. The *Alternantheras*, *Amaranthuses*, *Iresines*, and *Coleuses* furnish high and warm colours; while *Pyrethrum Parthenium aureum* yields greenish yellow; *Mesembryanthemum cordifolium variegatum*, creamy yellow; *Centaureas* and others, white; and the succulent *Echeverias* and *Sempervivums*, glaucous rosettes, which last add much to the general effect.

GREENHOUSE PLANTS.

These are plants requiring the shelter of a glass house, provided with a moderate degree of heat, of which 35° Fahr. may be taken as the minimum. The house should be opened more or less for ventilation in all mild weather in winter, and daily throughout the rest of the year.

The following is a very brief and select list of miscellaneous decorative plants in addition to special subjects which will be noticed separately :—

Abutilon Boule de Neige has pure white drooping bell-shaped flowers; *A. Lemoinei*, yellow; *A. Firefly*, scarlet.

Acacias are remarkably profuse-flowering plants with yellow flowers. *A. armata* and *A. Drummondii* are flowering bushes; *A. lophantha* has ample fern-like leaves; *A. Riceana* has pale yellow flowers in early spring, and is well suited for training up rafters or pillars.

Adenandra fragrans produces highly fragrant pink star-shaped flowers in May and June.

Agapanthus is very ornamental and easily grown, *A. umbellatus* having a large umbel of pale blue flowers, and *A. umbellatus albiflorus* white flowers.

Aphelaxis embraces various species of close-growing plants, half procumbent in habit, producing handsome purplish-crimson and rosy-pink everlasting flowers freely on the points of the shoots in May and June. *A. humilis* and *A. macrantha rosea* are distinct and good.

Aralias have large palmate leaves.

Araucaria excelsa and *A. Cookii* have regularly spreading branches resembling gigantic ostrich feathers.

Begonias. The new tuberous-rooted hybrids are very showy, and continue to flower all through the summer and autumn; the varieties are very numerous, some single, some double-flowered.

Blandfordias are strikingly handsome perennials with linear erect leaves, and spikes of large drooping funnel-shaped flowers; *B. nobilis*, *B. Cunninghamii*, and *B. princeps* are all fine plants with crimson and yellow flowers; *B. aurea* has golden-yellow blossoms.

Bomareas are fine tuberous-rooted climbers, bearing compound spikes of drooping tubulose flowers of great beauty; *B. Carderi* is rosy-pink spotted with purple, and *B. chontalensis* rose and yellow.

Boronias are a fine group of hard-wooded shrubs, having chiefly pink flowers, which bloom profusely from the mature wood; the best examples of the family are *B. pinnata*, *Drummondii*, *elatior*, and *serrulata*; *B. megastigma* is deliciously scented like violets.

Chorozemas are quick-growing slender-habited plants, with highly-coloured red and yellow pea-shaped flowers, produced in racemes from the axils of the leaves; *C. varium*, *cordatum*, and *spectabile* are fine and distinct.

Cordylines are stately plants, of which the principal are *C. indivisa*, with a noble crown of glaucous leaves marked by orange ribs, and *C. australis* with narrower leaves.

Cytisus racemosus is one of the best subjects for early spring blooming, of dense bushy habit, and bearing sweet scented yellow flowers; *C. Everestianus* has flowers of a deep orange.

Daphne indica, white, and *D. indica rubra*, pink, the flowers growing in terminal clusters, are unsurpassed for their perfume.

Dasyliirions have stout woody stems and large heads of narrow leaves; *D. glaucum* (fig. 127) is a narrow-leaved species of elegant habit.



FIG. 127.—*Dasyliirion glaucum*.

Epacris is a winter-flowering genus, easily grown and free-blooming, some of the best sorts being *E. hyacinthiflora candidissima*, *hyacinthiflora carminata*, *miniata*, and the pure white *oncosmæflora flore-pleno nivalis*.

Grevilleas are shrubs of slender habit, some having handsome flowers, while *G. robusta* and others almost rival the ferns in the elegance of their leaves.

Hydrangea Hortensia produces immense heads of bloom of a delicate pink, which continue long in flower, and may be changed to blue by the admixture of iron filings with the soil.

Imantophyllum miniatum is a grand plant, the umbels of pale flame-red flowers being produced at various seasons; there are some fine seminal forms.

Kalosanthes consists of splendid flowering plants, which, however, rarely bloom well two years in succession; *K. coccinea* and its varieties are exceedingly brilliant.

Lachenalia pendula, *luteola*, and *tricolor* are exceedingly pretty dwarf bulbs, useful about April and May, and *L. Nelsoni* is a beautiful novelty.

Lapageria rosea is one of the very finest greenhouse climbers in existence, and bears waxy bell-shaped red flowers, mottled with white; *L. rosea alba* is if possible still more beautiful, being of a clear waxy white.

Lilium auratum (fig. 128), *speciosum*, and *Krameri* are fine, *L. auratum* being one of the noblest flowering plants in existence; *L. eximium* and *longiflorum* are fine tubular white-flowered sorts.

Mandevilla suaveolens, a strong-growing climber, bears beautiful, fragrant, trumpet-shaped white blossoms in August and September.

Neriums are tall strong-growing shrubby subjects, with flowers of great beauty, produced in cymes from the points of the mature shoots; there are several new colours besides the original rose and white.

Passifloras produce their showy singularly-formed flowers most profusely, and are very suitable for decorating the roof of a conservatory.

Pimeleas are free-growing, compact-habited plants, producing flower-heads from the points of the shoots; *P. spectabilis rosea* has flower-heads, white flushed with rose, almost as large as those of a guelder-rose; *P. Hendersoni* has deep pink, *P. hispida* white, and *P. elegans* straw-coloured flowers.

Pleroma elegans is a free-flowering melastomaceous shrub, producing in succession its lovely saucer-shaped flowers of the most intense purple hue, from June to September.

Plumbago capensis is another abundant bloomer, and one of the very best of greenhouse climbers, with large bunches of delicate grey-blue flowers.

Rhododendrons furnish a large contingent, of which the most suitable are *Countess of Haddington*, *Dalhousie*, *Edgworthii*, *Gibsoni*, *Thompsoni*, *javanicum*, with *jasminiflorum* and its beautiful varieties, *Princess Royal*, *Princess Alexandra*, *Princess of Wales*, *Duchess of Edinburgh*, and others.

Schizostylis is a beautiful bulbous plant from *Caffraria* and *Natal*, with flowers resembling those of *Ixia*. The only species, *S. coccinea* (fig. 129), has sword-shaped keeled leaves, and scapes 2 to 3 feet high, bearing long spikes of large showy crimson flowers, which bloom through the autumn months.



FIG. 128.—*Lilium auratum*.

It is a most useful plant for greenhouse decoration in autumn, for which purpose it should be planted out in spring in rich peaty soil on a sunny border, and the little tufts potted up in the early autumn for flowering. It may also be grown in pots protected against frost.

Statice include some very highly ornamental plants, especially *S. brassicæfolia*, *profusa*, and *imbricata*.

Tacsonias are magnificent climbers; indeed, *T. Van Volxemii* is one of the very finest of the climbing plants which flower in autumn; *T. exoniensis* and *insignis* are also fine showy climbers.

Trachelospermum jasminoides, better known as *Rhynchospermum*, very fragrant, and moderately vigorous, is suitable for a pillar, and produces white flowers in May and June.

Tropæolums are charming pot climbers, of which may be mentioned *T. azureum*, *brachyceras*, *speciosum*, *tricolorum*, and *Jarrottii*; besides the varieties of *T. Lobbianum* which flower in winter in a warm house.

Vallota is a very choice ever-green bulb, *V. purpurea* producing highly-coloured scarlet flowers, in umbels, in August and September.



FIG. 129.—*Schizostylis coccinea*.

Agave.—Bold-habited succulent plants, some of the larger of which are well adapted for conservatory decoration and prominent situations on terraces, &c. The American Aloe, *Agave americana*, with its varieties *variegata* and *mediopicta*, all require to be kept moderately dry and safe from frost during the winter, and grow well in strong loam, sand, and rotten manure. Among others of the larger varieties are *A. potatorum* and *miradorensis*, and of the smaller ones, *A. filifera*, *applanata*, *Verschaffeltii*, and *schidigera*. Still smaller dense-growing sorts are *A. Richardsii*, *horrida*, *Victoriæ Reginæ*, and *Bessereriana*.

Aloe.—Succulent plants, extremely variable in character. They all thrive best in a sandy loam, well drained, and not over-watered. The old Partridge-beast Aloe, *A. variegata*, is well adapted for a window; *A. ferox*, *supralævis*, and *arborescens* are tall plants; *A. saponaria*, *mitræformis*, *albocincta*, and *lineata* are smaller; *A. serra*, *variegata*, *humilis*, and *serrulata* are dwarf. The Fan Aloe,

A. plicatilis, produces its flowers in winter. A group of dwarf showy-flowered aloes, often separated under the name of *Gasteria*, flower in early spring. The following are of a spiral habit of growth—*G. spiralis*, *obliqua*, *undata*, and *carinata*; while, of those of distichous growth, *G. nigricans*, *lingua*, *verrucosa*, and *intermedia* may be recommended. Besides these there are the *Apicras* and the *Haworthias*, all formerly known as *Aloes*, which are dwarf and neat.

Azalea.—The beautiful varieties now in cultivation have been bred from a few originals, natives of the hilly regions of India and China. They are perhaps unequalled as indoor decorative plants. The Chinese species, *A. vittata*, will commence to open its blooms in September, and other sorts keep up a succession for several months, for some of the varieties may be forced into bloom during the winter, and others flower through the spring up to May and June. They are usually increased by grafting the half-ripened shoots on the stronger-growing kinds, the shoots of the stock and the grafts being in a similarly half-ripened condition, and the plants being placed in a moist heat of 65°. Large plants of inferior kinds, if healthy, may be grafted all over with the choicer sorts, so as to obtain a large specimen in a short time. They require a rich and fibrous peat soil, with a mixture of sand to prevent it getting waterlogged. The best time to pot azaleas is three or four weeks after the blooming is over. The soil should be made quite solid to prevent its retaining too much water. To produce handsome plants, they must while young be stopped as required. Specimens that have got leggy may be cut back just before growth commences. The lowest temperature for them during the winter is about 35°, and during their season of growth from 55° to 65° at night, and 75° by day, the atmosphere being at the same time well charged with moisture. They are liable to the attacks of thrips and red spider, which do great mischief if not promptly destroyed.

Calceolaria (fig. 130).—Originally introduced under various specific forms from Chili and Peru, the *calceolaria* of the present day has been developed into a highly decorative plant, in which the herbaceous habit has preponderated. The plants are now very generally raised annually from seed, which is sown about the end of July in a mixture of loam, leaf-mould, and sand, and, being very small, must only be slightly covered. When the plants are large enough to handle they are pricked out an inch or two apart into 3-inch or 5-inch pots; when a little more advanced they are potted singly. They should be wintered in a greenhouse with a night

temperature of about 40°, occupying a shelf near the light. By the end of February they should be moved into 8-inch or 10-inch pots, using a compost of three parts good turfy loam, one part leaf-mould, and one part thoroughly rotten manure, with a fair addition



FIG. 130.—*Calceolaria*, specimen plant.

of sand. They need plenty of light and air, but must not be subjected to draughts. When the pots get well filled with roots, they must be liberally supplied with manure water. In the early stages of growth the plants are subject to the attacks of the green fly for which they must be fumigated. Named varieties are not now grown, as a good strain of seed will yield satisfactory flowers.

The shrubby calceolarias used for bedding are increased from cuttings, planted in autumn in cold frames, where they can be wintered by the use of mats and a good layer of litter placed over the glass and round the sides as a protection from severe frosts.

Camellia.—This favourite plant, a native of Japan, is deservedly popular, on account of its glossy foliage and magnificent flowers.

It is usually propagated by cuttings, to furnish stocks on which the choicer kinds are grafted. It will succeed either in peat or loam or a mixture of both, but in any case an addition of turfy fibre and of sand is also necessary. The plants should have abundance of water, especially in the growing season, and should be potted as they complete their growth and are about to set their flowers; they do not, however, require repotting so often as most plants. Fire heat need only be employed when the object is to obtain flowers in the autumn and winter months. To produce them at this season it becomes necessary to start the plants into growth correspondingly early. When grown in cold houses, they do not generally flower until about February or March, at which stage the plants enjoy a temperature of 45° or 50°. When fire heat is applied to assist the opening of the flowers, it should not much exceed 55°, and whilst the plants are subjected to this heat the atmosphere must on no account be allowed to become dry, or the buds will probably drop. When making their growth they need an abundant supply of water at the roots, as well as copious syringings twice a day, but as terminal buds become visible they should be kept drier. Liquid manure is of great assistance to plants that have flowered very heavily, while they are making their growth, and the addition of a little soot imparts a dark-green colour to the leaves. If grown in an open-roofed light house, shade will be required during very bright weather whilst the young shoots are being developed, but if grown in a lean-to house facing the north, shade will not be required. It is sometimes necessary to move the plants out of the house after they have set their flowers, to keep them from coming on too rapidly. In this case they should have placed over them a light framework and movable screen of tiffany.

The scale is the most troublesome insect which attacks the camellia. To remove the white scale, the plants should be washed with a sponge and solution of soft soap as soon as their growth is completed, and again before the buds begin to swell. The brown scale may be got rid of by repeated washings with one of the many insecticides, such as Fowler's, but it should be applied at a temperature of 90°.

Some of the best varieties are—*Alba plena* (old double white), *Bealii*, *Bonomiana*, *Candidissima*, *Chandler's Elegans*, *Contessa Lavinia Maggi*, *Countess of Ellesmere*, *Donckelaari*, *Eximia*, *Fimbriata*, *Henri Favre*, *Imbricata*, *Imbricata alba*, *Jubilee*, *Madame Ambroise Verschaffelt*, *Mathotiana*, *Mathotiana alba*, *Princess Mary*, *Reticulata flore-pleno*, *Saccol nova*, and *Valtavedo*.

Cineraria (fig. 131).—These handsome and varied decorative plants can be raised freely from seeds, and though there are named varieties which are increased by division, a good strain of seed will yield flowers almost as fine. They must be kept, especially while young, free from aphides, to which they are more than ordinarily subject. For spring flowering the seeds may be sown in April or May in well-drained pots or pans, in soil of three parts loam to two parts leaf mould, with one-sixth sand; cover the seed thinly with fine soil, and press the surface firm. When the seedlings are large enough to handle, prick them out in pans or pots of similar soil, and when



FIG. 131.—*Cineraria* blooms.

more advanced pot them singly in 4-inch pots, using soil a trifle less sandy. They should be grown in shallow frames facing the north, and, if so situated that the sun shines upon the plants in the middle of the day, they must be slightly shaded; give plenty of air, and never allow them to get dry. When well established with roots, shift them into 6-inch pots, which should be liberally supplied with manure water as they get filled with roots. In winter they should be removed to a pit or house, where a little heat can be supplied whenever there is a risk of their getting frozen. They should stand on a moist bottom, but must not be subjected to cold draughts. When the flowering stems appear, give manure water at every alter-

nate watering. Seeds sown in March, and grown on in this way, will be in bloom by Christmas if kept in a temperature of from 40° to 45° at night, with a little more warmth in the day; and those sown in April and May will succeed them during the early spring months, the latter set of plants being subjected to a temperature of 38° or 40° during the night.

Correa.—This genus of Australian plants is extremely useful for winter flowering. The best of them is *C. cardinalis*, which affords a succession of tube-shaped crimson flowers during the whole of the winter. They are increased by cuttings, and grown in rough peaty soil, with a slight addition of loam and sand. After the plants have done flowering, they should all get a little artificial warmth, plenty of moisture, and a slight shade, while they are making their growth, during which period the tips of the young shoots should be nipped out when 6 or 8 inches long. When the growth is complete, a half-shady place outdoors during August and September will be suitable, with protection from parching winds and hot sunshine.



FIG. 132.—*Cyclamen persicum*, specimen plant.

Cyclamen persicum (fig. 132).—Of late years this flower has been

so much improved that no plant of moderate size can be made to contribute more floral display in winter. It is raised from seeds in various shades of colour, from the purest white to a deep purple. The seeds should be sown in October or November, in well-drained seed-pans, in an equal mixture of fine loam and leaf-mould with an addition of sand, the seeds slightly covered, and the pans placed near the light in a temperature of 50° . When the seedlings appear, they must be pricked out into 5-inch pots, six or eight in each, and wintered in a similar temperature and situation. In spring they must be potted singly in 3-inch pots, and thinly shaded during bright weather. When they have filled their pots with roots they should be repotted, using similar soil, into 4-inch pots, in which

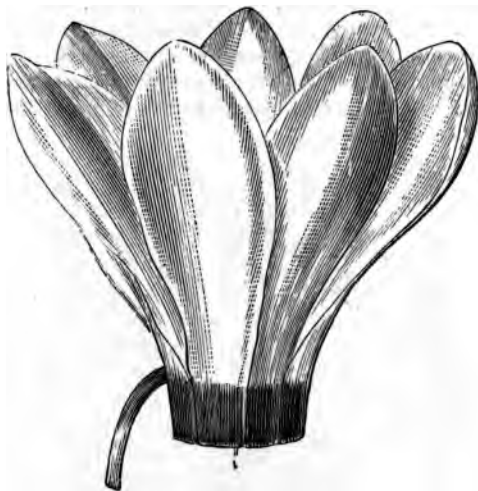


FIG. 133.—*Cyclamen persicum grandiflorum*, flower.

they are to flower. In potting, the corms or tuberous roots should not be more than half covered with the soil. A low house or pit is the best place in which to grow them, shading them if requisite, giving plenty of air, watering regularly, and syringing overhead in the afternoon to keep down thrips and red spider. The temperature should range from 45° to 50° , with plenty of air. They should flower in February and March. After blooming they should be placed in a pit where they can be shaded as required, and as they show signs of going to rest they should receive less water, but

should not be allowed to get quite dry. In autumn they may be shifted into pots a size larger, and they will come into flower earlier than in the first year. It is not advisable to keep them after the third season. Some growers recommend after flowering to turn the plants out of their pots into a bed of prepared peat or leaf-soil in some half-shadyspot, where they can be sprinkled overhead every afternoon during the sunny weather, so as to encourage plenty of healthy foliage. In this case they should be lifted early in the autumn. Of late years a large-flowered form called *C. persicum grandiflorum* (fig. 133) has been obtained, and of this both white and rosy forms are grown.

Erica.—The species of heaths cultivated in English greenhouses are mostly South African, or have sprung from South African originals. They are of dense twiggy growth, with needle-shaped leaves, and beautiful wax-like flowers, which in some or other of the kinds are produced almost throughout the year. During the winter and early months *E. caffra*, *gracilis*, *vernalis*, *hiemalis*, *melanthera*, *persoluta*, *rubens*, *Willmorei*, *Sindryana*, and others produce their blossoms; later on bloom *E. florida*, *affinis*, *Cavendishiana*, *exquisita*, *ventricosa* and its many varieties, and the charming *aristata*; next come *E. Savileana*, *Irbyana*, *Austiniana*, *Jacksoni*, *retorta major*, and others, which last on till September, a few continuing till the end of the year.

The varieties of heaths are propagated under bell-glasses by cuttings, which should be taken as soon in the spring as the wood is sufficiently firm, and planted in silver sand, the lower leaves having been removed; they should be kept in a temperature of 60°, and the glasses must be wiped occasionally to prevent the plants from damping off. When rooted they should be gradually inured to the air by the occasional removal of the glasses. In the spring following they should be potted singly into thumb pots, and kept close and moist until they take to the new soil. Heaths require peat soil, which for hard-wooded slow-growing kinds should be of a close hard texture, while for soft-wooded slow-growing sorts a mixture of two-thirds of hard peat with one of a softer nature, and for the soft-wooded quick-growing varieties equal quantities of hard and soft peat should be used, with silversand, according to the composition of the peat. The pots must always be well-drained, and the plants must never be allowed to become pot-bound. The best season for potting is in March and April, or in September when the summer heats are over. The new soil must be made as firm as the old ball, so as to retain the water. A low span-roofed house, admitting abundance of light, is

most suitable for these plants ; and they require air in abundance, especially during the season of active growth. They have so great a dislike to fire heat that any degree of cold short of actual frost is preferable to it. When they have grown into specimen plants they should be set out of doors, from the latter part of July till the beginning of September, in order to enable them to resist the attacks of mildew. Water should never be given before the soil has got sufficiently dry to need it, nor should the plants be syringed overhead summer or winter. Especially is this the case with the hard-wooded kinds.

Some of the best of the earlier flowering heaths are—*E. affinis*, *aristata*, *Bergiana*, *Candolleana*, *Cavendishiana*, *Devoniana*, *florida*, *hiemalis*, *Lindleyana*, *Massoni major*, *mutabilis*, *propendens*, *Sindryana*, *tortilliflora*, *ventricosa* and its varieties, *Victoria*, and *Willmorei*. The later ones are well represented by *E. Austiniana*, *ampullacea* and its varieties, *Aitoniana* *Turnbullii*, *ferruginea superba*, *gemmafera elegans*, *Hartnelli*, *Irbyana*, *jasminiflora alba*, *Marnockiana*, *obobata*, *Parmentieriana rosea*, *Paxtoni*, *Savileana major*, *Spenceriana*, *Shannoni*, *tricolor* and its varieties, and *vestita* and its varieties.

Fuchsia.—This well-known decorative soft-wooded plant comes from the temperate parts of South America, but has been improved by selection and hybridization. Fuchsias strike readily from cuttings, the most usual method being to place old plants in warmth about February, and as soon as they have pushed shoots a couple of inches or so in length, to take them off and put them in small pots, in a temperature of 60°; they will root in two or three weeks, when they should be moved singly into 3-inch pots; and they must be again shifted into 8-inch or 9-inch pots as soon as those they already occupy are moderately filled with roots. The leading shoot, as well as the side branches, should be topped two or three times during the spring, and a single stick placed to the main stem so as to keep it upright. They should be syringed in the afternoons, to promote growth and to keep down aphides and red spider. By the end of June or July such plants will be disposed to flower. A good compost for fuchsias consists of four parts good fibrous loam to two parts well-rotted manure and leaf-mould, with a fair sprinkling of sand. When larger plants are required the cuttings should be struck about the end of July or beginning of August, and kept gently growing through the autumn and winter in 6-inch pots on a shelf near the glass, with a night temperature of 50°. At the end of February they should be shifted into 10-inch or 12-inch pots, and by the end of April they will be in a condition to move to 16-inch or 18-inch pots, and the temperature should be raised to 55°. The

shape of the plants should be regulated by timely pinching of the shoots, the pyramidal and standard forms being the most elegant. The old plants may be kept during winter in any dryish place free from frost; prune them back in spring, and repot in fresh soil. The varieties are constantly changing through the introduction of novelties. The larger growing *F. corymbiflora* is a very handsome plant.

Heliotropium.—The Peruvian Heliotrope, *Heliotropium peruvianum*, is a great favourite with cultivators, on account of the delicious fragrance of its blossoms, which has obtained for it the popular name of "cherry pie." The plants are easily increased by cuttings, which are struck in July and August, or from young shoots obtained in heat in early spring; when rooted they should be potted singly into small pots, using as a compost fibry loam, sandy peat, and well-decomposed stable manure from an old hotbed. The plants soon require to be shifted into a pot a size larger. To secure early-flowering plants, cuttings should be struck in August, potted off before winter sets in, and kept in a warm greenhouse. In the spring larger pots should be given, and the plants shortened back to make them bushy. They require frequent shiftings during the summer, to induce them to bloom freely. There are many varieties, differing in habit and in the colour of their flowers.

The heliotrope makes an elegant standard. The plants must in this case be allowed to send up a central shoot, and all the side growths must be pinched off until the necessary height is reached, when the shoot must be stopped and lateral growths will be produced to form the head. During winter they should be kept somewhat dry, and in spring the ball should be reduced and the plants repotted, the shoots being slightly pruned, so as to maintain a symmetrical head. Where they are planted out against the walls and pillars of the greenhouse or conservatory an abundance of highly-perfumed blossoms will be supplied all the year round.

Mesembryanthemum.—These are interesting Cape plants, some of them of a very showy character, and others remarkable as curiosities. They belong to the class of succulents, and with the exception of the curious sorts, all grow and strike freely in a mixture of loam and leaf-mould with a dash of sand. The flowering kinds should be kept only two or three years. Cuttings should be put in about May, and well exposed. They will stand a few degrees of frost, but should be kept from growing in winter.

The best flowering sorts, most of which are adapted for window-boxes, are—*M. barbatum*, *blandum*, *candens*, *conspicuum*, *curviflorum*, *falcatum*, *formosum*, *glaucum*, *polyanthum*, *reflexum*, *retroflexum*, *roseum*, and *specta-*

bile. These can be used for sunny summer beds very well, as those that require it can be pegged down. Of the curious varieties, some of the choicest are *M. agninum*, *albinum*, *caninum*, *felinum*, *murinum*, *tigrinum*, *vulpinum*, *dolabriforme*, *densum*, *fissum*, *linguaeforme*, *minimum*, *obconellum*, and *octophyllum*. These are all dwarf growers, and require more sand and some brick rubbish in the soil; they should also have less water.

Pelargonium.—The various races of pelargoniums have sprung from the intermixture of some of the species obtained from the Cape. The older show-flowered varieties have been gradually acquired through a long series of years; and the fancy varieties, as well as the French spotted varieties and the market type have been evolved from them. The zonal race, on the other hand, has been perfected within the last quarter of a century. In all the sections the varieties are of a highly ornamental character, but for general cultivation the market type is preferable for indoor purposes, while the zonals are effective either in the greenhouse or flower garden. Some of the Cape species are still in cultivation,—the leaves of many of them being beautifully subdivided, almost fern-like in character, and some of them deliciously scented. A few of these are well adapted for bedding out.

Some of the most striking of this set are—*P. Blandfordianum*, *echinatum*, *graveolens*, *melananthum*, and *Schottii*. The following sorts have finely-scented leaves:—*P. capitatum*, *citriodorum*, *crispum*, and *odoratissimum*. To these may be added, from amongst the earlier hybrids, those named *Lady Plymouth*, *Fair Helen*, *ignescens*, *Moore's Victory*, *Pretty Polly*, *quercifolium* and its varieties, *Shrubland Pet*, and the various sports from *Unique*.

The best soil for pelargoniums is a mellow fibrous loam with good stable manure in about the proportion of one-fifth; when used it should not be sifted, but pulled to pieces by the hand, and as much sand should be added as will allow the water to pass freely through it. The large-flowered and fancy kinds cannot bear so much water as most soft-wooded plants, and the latter should have a rather lighter compost.

All the pelargoniums are readily increased by cuttings made from the shoots when the plants are headed down after flowering, or in the spring, when they will root freely in a temperature of 50°. They must not be kept too close, and must be very moderately watered. When rooted they may be moved into well-drained 3-inch pots, and should have the points pinched out in order to induce them to push out several shoots near the base. These shoots are, when long enough, to be trained in a horizontal direction; and when they have made three joints they should have the points again pinched

out. These early-struck plants will be ready for shifting into 6-inch pots by the autumn, and should still be trained outwards. The show varieties after flowering should be set out of doors in a sunny spot to ripen their wood, and should only get water enough to keep them from flagging. In the course of two or three weeks they will be ready to cut back within two joints of where these were last stopped, when they should be placed in a frame or pit, and kept close and dry until they are broken. When they have pushed an inch or so, turn them out of their pots, shake off the old soil, trim the straggling roots, and repot them firmly in smaller pots if practicable; keep them near the light, and as the shoots grow continue to train them outwardly. They require to be kept in a light house, and to be set well up to the glass; the night temperature should range about 45°; and air should be given on all mild days, but no cold currents allowed, nor more water than is necessary to keep the soil from getting parched. The young shoots should be topped about the end of October, and when they have grown an inch or two beyond this, they may be shifted into 7-inch pots for flowering. The shoots must be tied out so as to be fully exposed to the light. If required to flower early they should not be stopped again; if not until June they may be stopped in February.

The fancy varieties root best early in spring from the half-ripened shoots, but they are slow growers, rather delicate in constitution, and very impatient of excess of water at the root.

The zonal or so-called "scarlet" varieties are almost continuous bloomers, and of much value as decorative subjects; they seldom require much pruning after the first stopping. For winter flowering, young plants should be grown on during the summer, and not allowed to flower. When blossoms are required, they should be placed close up to the glass in a light house with a temperature of 60°, only just as much water being given as will keep them growing. For bedding purposes the zonal varieties are best struck towards the middle of August in the open air, taken up and potted or planted in boxes as soon as struck, and preserved in frames or in the greenhouse during winter.

Petunia (fig. 134) —The varieties of *petunia*, especially the double forms, make admirable specimens for pot culture. These and the other named varieties are propagated by cuttings taken from stock plants kept through the winter on a dry warm shelf, and moved into a brisk moist heat in early spring; the young shoots are planted in pans or pots filled with sandy soil, and, aided by a brisk

bottom heat, strike root in a few days. They are then potted singly into thumb-pots, and when once established are gradually hardened off, and afterwards repotted as required. The shoots should be topped to make bushy plants, and these tops may be utilized as cuttings. The single varieties are raised from seeds sown in light sandy soil in heat, in the early spring, and very slightly covered. The plants need to be pricked out or potted off as soon as large enough to handle. Good strains of seeds supply plants suitable for



FIG. 134.—*Petunia hybrida grandiflora*.

bedding; but, as they do not reproduce themselves exactly, any sorts particularly required must be propagated, like the double ones, from cuttings.

Primula (fig. 135).—One of the most popular of winter and early spring decorative plants is the Chinese Primrose, *Primula sinensis*, of which some superb strains have during the last few years been obtained. For ordinary purposes young plants are raised annually from seeds, sown about the beginning of March, and again for succession in April, and if needed in May. The seed should be sown in well-drained pans, in a compost of three parts light loam, one part well-rotted leaf-mould, and one part clean gritty sand, as it does not germinate freely if the soil contains stagnant moisture.

The surface should be pressed smooth and gently watered before sowing, and the seeds should be only just covered with some very fine compost, half soil half sand, and over that a thin layer of chopped sphagnum to keep it damp, and obviate the necessity of watering. When the seeds germinate, remove the moss, and place them in a well-lighted position near the glass, shading them from the sun with thin white paper, and giving water moderately as required. When they are large enough to handle, prick them out in pans or shallow boxes, and, as soon as they have made leaves an inch long, pot them singly in 3-inch pots, using in the soil a little rotten dung. They should then be placed in a light frame near the glass in an open situation, facing the north. When their pots are filled with roots they should be moved into 5-inch or 6-inch pots. The soil should now consist of three parts good loam broken with the hand, one part rotten dung and leaf-mould, and as much sand as will keep the whole open. They should be potted firmly, and kept in frames close up to the glass till September, excess in watering being carefully avoided. In the autumn they should be transferred to a light house and placed near the glass, the atmosphere being kept dry by the occasional use of fire heat. The night temperature should be kept about 45°. When the flowering stems are growing up, manure water once or twice a week will be beneficial. The semi-double varieties are increased from seeds, but the fully double ones and



FIG. 135.—*Primula sinensis*.

When the flowering stems are growing up, manure water once or twice a week will be beneficial. The semi-double varieties are increased from seeds, but the fully double ones and

any particular sort can only be increased by cuttings made by dividing the crowns with a portion of stem attached, the plants being first well dried, almost to shrivelling; the cuttings should be placed in small pots in sandy soil, put in a moderate dryish heat, and only just watered enough to prevent flagging. When they are well rooted, they may be potted like the others. In winter they require an intermediate temperature of 45° or 50° at night, and a little higher in the day, with air when the weather is suitable.

Richardia.—This plant *R. æthiopica* (fig. 136), called also *Calla æthiopica* and the Nile Lily, is a fine subject for greenhouse decoration during the spring months. It is a stately tuberous-rooted perennial, with broad arrow-shaped leaves, and large white flower-spathes, that last long in beauty. The plants should be carefully divided about March, and planted out during May in well-enriched shallow trenches. Being semi-aquatics, they cannot be kept too moist all through the summer months. Plants kept in pots are generally neglected in this way, and hence are rarely seen in really first-class condition. The



FIG. 136.—*Richardia æthiopica*.

Richardias are hardy if their crowns are kept under water; but a very little frost disfigures the foliage, and therefore they should be placed in the pits or the greenhouse towards the end of October. They may be had in flower during the winter, but in that case they must have a little warmth to give them a start.

Salvia.—Some of the *Salvias* or Sages are among the best and most showy among soft-wooded winter-flowering plants, the blossoms being of a bright glowing scarlet. The most useful are *S. splendens* and its variety *Bruanti*, *S. Heeri*, *S. involucrata* *Bethellii*, and *S. gesneræflora*, the first commencing to flower early in the

autumn and lasting till Christmas, while the others follow immediately in succession, and continue in full beauty till April. Young plants should be propagated annually about February, and after nursing through the spring should be grown outdoors in a fully exposed situation, where they can be plunged in some loose material, such as ashes, fibre, or half-decomposed leaves. The young shoots should be stopped to secure bushy plants, but not later than the middle of August. The most suitable compost for them is a mixture of mellow fibry loam enriched with a fourth part thoroughly decomposed manure, made sufficiently porous by the addition of sand or grit. In spring, and during the blooming period, the temperature should be intermediate between that of a stove and greenhouse. There are other very ornamental species of easy growth, increased by cuttings in spring, and succeeding well in ordinary rich loamy soil. Of these *S. angustifolia* bears spikes of fine bright blue flowers about June; *S. chamædryoides*, a dwarfish subject, has deep blue flowers in August; *S. fulgens* produces scarlet flowers in August; and *S. involucrata* produces fine rosy pink flowers during the autumn. *S. patens* is a lovely blue free-blooming sort, flowering in August and September, the colour being unique.

STOVE PLANTS.

For the successful culture of stove plants two houses at least, wherein different temperatures can be maintained, should be devoted to their growth. The temperature during winter should range at night from about 55° in the cooler to 65° in the warmer house, and from 65° to 75° by day, allowing a few degrees further rise by sun heat. In summer the temperature may range 10° higher by artificial heat, night and day, and will often by sun heat run up to 90° or even 95° beyond which it should be kept down by ventilation. During the growing period the atmosphere must be kept moist by damping the walls and pathways, and by syringing the plants, according to their needs; when growth is completed less moisture will be necessary. Watering, which, except during the resting period, should generally be copious, is best done in the forenoon; while syringing should be done early in the afternoon to admit of the foliage drying moderately before night. When the pots become filled with roots, waterings of weak liquid manure help very much towards a successful blooming. In ventilating, cold draughts must be avoided.

The following are desirable select miscellaneous stove plants :—

Acalypha tricolor (Wilkesiana), *musaica*, and *marginata*.
Echmea fulgens, *Maris Regine*, *miniata*, and *Veitchii*.
Æschynanthus Boschianus, *Lobbianus*, *pulcher*, *speciosus*, and *splendens*.
Allamanda Chelsoni, *Schottii*, *grandiflora*, *Hendersoni*, and *nobilis*.
Alocasia Jenningsii, *Lowii*, *Veitchii*, *macrorrhiza variegata*, and *metallica*.
Anthurium crystallinum (fig. 137), *magnificum*, *regale*, *Warocqueanum*,



FIG. 137.—*Anthurium crystallinum*.

Veitchii, remarkable for their noble and handsome foliage ; and *A. Scherzerianum*, and *Andréanum* (fig. 138 from the *Gardeners' Chronicle*), remarkable for the brilliant scarlet bracts of their inflorescence.
Aphelandra nitens, *Roezlii*, *fascinator*, and *Leopoldii*.
Aralia elegantissima, *filicifolia*, *leptophylla*, *Veitchii*, and *gracillima*.
Ardisia crenulata, *crenulata alba*, and *Oliveri*.
Aristolochia Duchartrei, *floribunda*, *gigas*, and *grandiflora*.
Bertolonia superbissima, *Van Houttei*, *guttata*, *Marchandi*, and *Mirandee*.
Bignonia Chamberlaynii, *speciosus*, and *venusta*.
Bougainvillea glabra, *lateritia*, and *spectabilis*.
Centropogon Lucyanus.
Cissus discolor.
Clerodendrum fallax, *Kämpferi*, *Thomsonæ*, *Balfourianum*, and *splendens*.
Combretum purpureum and *grandiflorum*.
Croton angustifolius, *trilobus Disraeli*, *Andréanus*, *gloriosus*, *majesticus* (fig. 139), *undulatus*, *Weismanni*, *spiralis*, *Kingianus*, and many others.
Cyanophyllum magnificum and *spectandum*.
Cyrtanthera magnifica and *chrysostephana*.
Dieffenbachia Bausei, *Leopoldii*, *Carderi*, *illustris*, *nobilis*, and *splendens*.
Dipladenia boliviensis, *splendens*, *Brearilyana*, *regina*, *amœna*, and *amabilis*.
Fittonia argyroneura and *Pearcei*.

Ficus elastica (India-rubber Plant), *religiosa*, and *dealbata*.
Franciscæa eximia, *calycina major*, *magnifica*, and *confertiflora*.
Gardenia amoena, *Stanleyana*, *citriodora*, *florida*, *intermedia*, and *Fortunei*.



FIG. 138.—*Anthurium Andréanum*.

Gesnera Cooperii, *Donckelaeri* (fig. 140), *Duvallii*, *macrantha*, and *superba*.
Glonera jasminiflora also referred to *Psychotria*.

Hibiscus rosa sinensis and its varieties—*miniatus*, *semiplenus*, *vivicans*, *zebrinus*, *puniceus*, *Collerii*, *fulgidus*, *schizopetalus*, and *Cooperii*.
Hoya imperialis, *carnea*, *campanulata*, *Paxtoni*, and *bella*.
Ipomoea Horsfalliae and *Learii*.
Ixora coccinea, *Colei*, *javanica*, *splendens*, *regina*, *Dixiana*, *Fraseri*, *princeps*, *Prince of Orange*, *Williamsii*, and many others.
Jasminum gracile, *gracillimum*, *ligustrifolium*, and *Sambac flore-pleno*.
Libonia floribunda and *penrhosiensis*.
Luculia gratissima and *Pinceana*.

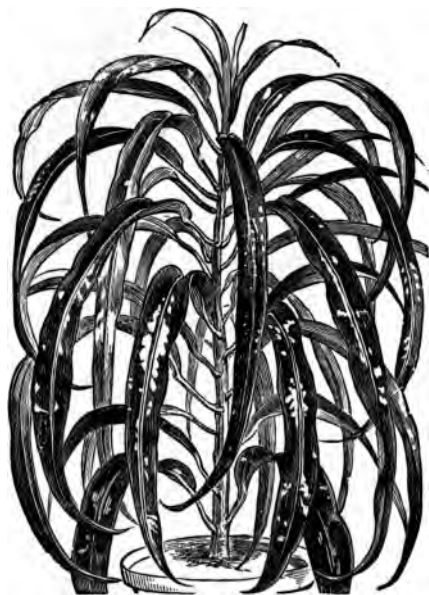


FIG. 139.—*Croton majesticus*.

Manettia bicolor, *cordata*, and *micana*.
Maranta fasciata, *albo-lineata*, *roseo-lineata*, *Makoyana*, *regalis*, *roseo-picta*, *Veitchii*, *zebrina*, *Massangeana*, and many others.
Medinilla magnifica and *amabilis*.
Meyenia erecta.
Nelumbium speciosum, the Sacred Bean, a splendid aquatic.
Nepenthes (Pitcher-Plant) *Veitchii*, *sanguinea*, *laevis*, *Stewartii*, *Williamsii*, *Hookeri*, and *Rafflesiana*.
Nymphaea Devoniana, *dentata*, and *cœrulea*, all beautiful aquatic plants.
Pandanus graminifolius, *elegantissimus*, *Vandermeerschii*, and *Veitchii*.
Pancratium amœnum, *caribbæum* (fig. 141), *ovatum*, and *fragrans*.

Passiflora fulgens, *Raddiana* (kermesina), *Decalsneana*, *Buonapartes*, *Hahnii*,
edulis, and *princeps racemosa*.
Pavetta borbonica.
Pavonia multiflora, or *Wistii*.
Pentas carnea rosea and *kermesina*.
Phyllanthus nivosus, *roseo-pictus*, and *atropurpureus*.
Plumbago rosea and *coccinea superba*.
Rogiera cordata, *macrophylla*, and *gratisima*.
Rondeletia brilliantissima and *speciosa major*.



FIG. 140.—*Gesnera Donckelaeri*.

Russelia juncea.
Scutellaria Mociniana and *pulchella*.
Sericographis Ghiesbreghtiana.
Sonerila Hendersoni and *margaritacea*, with their several varieties.
Stephanotis floribunda.
Sphærogyne latifolia.
Thunbergia Harrisii, *chrysops*, *coccinea*, and *fragrans*.
Thyracanthus rutilans.
Tillandsia musalca, *tesellata*, *Lindeniana*, *splendens*, and *Zahnii*.
Tornella fragrans (*Monstera deliciosa*), remarkable for its luscious fruit.
Torenia asiatica, *pulcherrima*, *Fournieri*, and *Bailloni*.

Victoria regia, a truly regal aquatic plant, the Queen of Water Lilies.
Vinca rosea, *rosea oculata*, and *rosea alba*, pretty free-flowering dwarf shrubs.

Achimenes (fig. 142) have scaly tubers, which are kept dry and in a state of rest in a temperature of 55° during the winter months, and started into growth about March, a second batch being started in April. They should be placed 6 inches asunder in pans filled to within 1½ inches of the rim with leaf-mould or cocoa-refuse, made rather sandy and slightly covered with the soil. The pans should be set in a warm pit or frame, and the soil kept slightly moistened,



FIG. 141.—*Paneratum caribbeum*.

and when the young shoots are a couple of inches long they may be placed six or eight in a 6-inch pot, in a soil of three parts fibrous loam and two parts leaf-mould, mixed with a little sand. The temperature should be from 65° to 70°, and they should be well exposed to light. When 6 inches long, pinch out the points to induce them to branch, and give more water, syringing overhead to keep red spider in check. As soon as the flower buds appear, give weak manure water two or three times a week. They should all through their growth have sufficient air to keep them from getting drawn, and when the flowers begin to open should be gradually inured to bear the temperature of the conservatory. When they

show signs of going to rest, less water may be given ; and after



FIG. 142.—*Achimenes*, group of varieties.

the tops have died down, the tubers may be stored in dry sand in a temperature of about 55°. *Achimenes* have also a very fine effect when grown in wire baskets suspended from the roof of the plant house. *A. longiflora* (fig. 143) is a typical species.

The following are good kinds :—*Ambroise Verschafelt*, *beimontensis*, *Firefly*, *longiflora alba*, *longiflora major*, *Mauve Queen*, *Parsonsi*, *Rose Queen*, *Stella*, and *Williamsii*.

Amaryllis.—This genus, also called *Hippeastrum*, consists of splendid bulbous plants, of easy culture and free-blooming habit. Like other



FIG. 143.—*Achimenes longiflora*.

bulbs they are increased by offsets, which should be carefully removed when the plants are at rest, and should be allowed to attain a fair size before removal. These young bulbs should be potted singly in February or March, in mellow loamy soil with a moderate quantity of sand, about two-thirds of the bulb being kept above the level of the soil, which should be made quite solid. They



FIG. 144.—*Amaryllis Cleopatra*.

should be removed to a temperature of 60° by night and 70° by day, very carefully watered until the roots have begun to grow freely, after which the soil should be kept moderately moist. As they advance the temperature should be raised to 70° at night, and 80° or higher with sun heat by day. They do not need shading, but should have plenty of air, and be syringed daily in the afternoon. When growing they require a good supply of water. After the decay

of the flowers they should be returned to a brisk moist temperature of from 70° to 80° by day during summer to perfect their leaves, and then be ripened off in autumn. Through the winter they should have less water, but must not be kept entirely dry. The minimum temperature should now be about 55°, to be increased 10° or 15° in spring. As the bulbs get large they will occasionally need shifting into larger pots.

A few of the best sorts are—*Ackermanni pulcherrima*, *aulica*, *conspicua*, *Cleopatra* (fig. 144), *Duchess of Connaught*, *Hercules*, *Leopoldii*, *Meteor*, *Mrs Baker*, *Mrs Morgan*, *Oriflamme*, *pardina*, *pyrochroa*, *Queen Victoria*, *striata superba*, *Thalia*, *Unique*, *Virgil*, and *vittata*. New varieties are being constantly raised.

Begonias are represented by numerous species, herbaceous and subshrubby. There are several free-flowering species and hybrids, such as *B. fuchsioides*, *weltoniensis*, *Saundersii*, *prestoniensis*, *ascotiensis*, &c. ; a group of ornamental-leaved kinds represented by *B. Rex* ; and a tuberous-rooted free-blooming brilliant race, developed recently, mainly from *B. boliviensis* and *B. Veitchii*.

Cuttings from flowering *begonias* root freely in sandy soil, placed in heat at any season when moderately firm, and as soon as rooted should be potted singly into 3-inch pots, in sandy loam mixed with leaf-mould and sand. They should be topped to keep them bushy, placed in a light situation, and thinly shaded in the middle of very bright days. In a few weeks they will require another shift. They should not be overpotted, but instead assisted by manure water. The pots should be placed in a light pit near the roof glass. The summer-flowering kinds will soon commence blooming, but the autumn and winter-flowering sorts should be kept growing in a temperature of from 55° to 60° by night, with a few degrees more in the day. The tuberous-rooted sorts require to be kept at rest in winter, in a medium temperature, almost but not quite dry. In February they should be potted in a compost of sandy loam and leaf-mould, and placed in a temperate pit until May or June, when they may be moved to the greenhouse for flowering. If they afterwards get at all pot-bound, weak manure should be applied. After blooming the supply of water must be again slackened, and in winter the plants should be stored in a dry place, secure from frost ; they are increased by late summer and autumn cuttings, after being partially cut down.

Bouvardia.—These plants are best increased by cuttings taken off in April, and placed in a brisk heat in a propagating frame with a close atmosphere. When rooted they should be potted singly

into 3-inch pots in fibrous peat and loam, mixed with one-fourth leaf-mould, and a good sprinkling of sand, and kept in a temperature of 70° by night and 80° during the day; shade when required; syringe overhead in the afternoon, and close the house with sun-heat. The plants should be topped to ensure a bushy habit, and as they grow must be shifted into 6-inch or 7-inch pots. After mid-summer they should be moved to a cool pit, where they may remain till the middle of September, receiving plenty of air and space. They should then be removed to a house, and a portion of the plants should be put at once in a temperature of about 70° at night, with a few degrees higher in the day time, to bring them into flower. Others must be moved into heat to supply flowers in succession through the winter and spring. Some of the best kinds are *B. elegans*, Hogarth, *jasminiflora*, Maiden's Blush, and *Vreelandii*.

Cactus.—This old-fashioned name, though left without a modern representative, includes many showy genera:—

Cereus is well represented by the splendid crimson and purple-flowered *C. speciosissimus*, a quadrangular-stemmed spiny plant, requiring stove heat, and a loamy soil freely mixed with hard drainage material; it must not be overpotted.

Echinocactus consists of dwarf spiny slow growing plants, and must have plenty of sun heat; they require sandy loam, with sand and bricks finely broken, and must be potted firmly, and kept dry in winter.

Echinopsis is a group of dwarfish plants resembling the *Echinocacti*, flowers about a foot long, varying from white to deep rose.

Epiphyllum is a group of handsome showy plants easily increased from cuttings, but from their drooping habit they are better adapted for grafting on the *Pereskia*, so as to form small standards. The *Pereskia* stocks are struck during the winter or spring from cuttings placed in heat, and should be grown in sandy loam, the pots being well drained; these must be kept to a single stem, and when a foot or 18 inches high, and of a firm woody texture, should be grafted with small pieces of the *Epiphyllum*. They may be grown for a considerable time in 6-inch or 7-inch pots, but must have free drainage. After grafting they should be grown on in heat and in plenty of light through the summer, but by the autumn should have less warmth and moisture. A winter temperature of 50° will be sufficient, but in January a portion may be started in a temperature of 60°, in which they will soon show flower. This treatment being continued they will last for many years, and go on increasing

in size. There are a number of varieties of *E. truncatum*, differing chiefly in the amount and shade of rose colour or crimson in the flowers.

Mammillaria consists of very interesting dwarf plants, remarkable for their numerous coloured spines, and the irregular arrangement of the mammillæ on their surface. They grow freely in a cool greenhouse, and require moderate watering in summer, with occasional syringing overhead. The spines are in some species white, in others yellow, or red, or brown, or almost black.

Opuntia is the prickly pear of southern Europe, or Indian fig of South America; the species are scarcely ornamental plants, but are interesting on account of their variable development. The cochineal insect is reared on some of the larger-growing sorts. *O. vulgaris* and *Rafinesquiana* are hardy in the south of England.

Phyllocactus is one of the most ornamental genera, of easy culture, requiring dry stove treatment. Cuttings strike readily in spring before growth has commenced; they should be potted in 3-inch or 4-inch pots, well-drained, in loamy soil made very porous by the admixture of finely-broken crocks and sand, and placed in a temperature of 60°; when these pots are filled with roots they are to be shifted into larger ones, but overpotting must be avoided. During the summer they need considerable heat, all the light possible, and plenty of air. In winter a temperature of 45° or 50° will be sufficient, and they must be kept tolerably dry at the root. By the spring they may have larger pots if required, and should be kept in a hot and fairly moistened atmosphere; and by the end of June, when they have made new growth, they may be turned out under a south wall in the full sun, water being given only as required. In autumn they are to be returned to a cool house, and wintered in a dry stove. The turning of them out-doors to ripen their growth is the surest way to obtain flowers, but they do not take on a free blooming habit until they have attained some age. Amongst the best sorts are *P. Ackermanni*, *Jenkinsoni*, *crenatus*, and *speciosus*.

Caladium.—These beautiful arads are increased by division of the young growths made in the spring. They should be potted in small pots in fibrous sandy peat, well drained, and kept in a temperature of 65° by night; afterwards they should be changed into larger ones, using lumpy soil. The summer temperature may range about 68° or 70° by night, with an increase of 10° by day. The plants will go to rest towards autumn, and when the leaves have all died away the soil may be allowed to become nearly dry, and

the pots may be set on a shelf, in a temperature of about 55°, till February.

Coleus.—These are very ornamental plants, the colour of their leaves being exceedingly varied, and often very brilliant. They are of the easiest culture. The cuttings of young shoots should be propagated every year, about March, being planted in thumb pots, in sandy loam, and placed in a close temperature of 70°. After taking root they should be shifted into 6-inch pots, using ordinary light loamy compost, containing abundance of leaf-mould and sand, and keeping them near the light. They may be passed on into larger pots as often as required, but 8-inch pots will be large enough for general purposes, as they can be fed with liquid manure. The young spring-struck plants like a warm growing atmosphere, but by midsummer they will bear more air and stand in a greenhouse or conservatory. They should be wintered in a temperature of 60° to 65°. The stopping of the young shoots must be regulated by the consideration whether bushy or pyramidal plants are desired.

Dracena.—These are extremely useful as decorative stove plants, and are easy to grow. They may be increased by cuttings planted in sandy soil in a temperature of from 65° to 70° by night, the spring being the best time for propagation. The old stems laid flat in a propagating frame will push young shoots, which may be taken off with a heel when 2 or 3 inches long, and planted in sandy peat in 3-inch pots; the tops can also be taken off and struck. The established plants do best in fibry peat made porous by sand. In summer they should have a day temperature of 75°, and in winter one of 65°. Shift as required, using coarser soil as the pots become larger. By the end of the summer the small cuttings will have made nice plants, and in the spring following they can be kept growing by the use of manure water twice a week. Those intended for the conservatory should be gradually inured to more air by midsummer, but kept out of cold draughts. When the plants get too large they can be headed down and the tops made cuttings. *D. terminalis*, with its bronzy leaves and rosy variegation, still ranks amongst the best sorts, but there are also many novel varieties of great merit and beauty. *D. Goldieana* is a grandly variegated species from tropical Africa, and requires more heat.

Eucharis.—The *Eucharis amazonica* (fig. 145) is the most chastely beautiful of all decorative plants, having white flowers, of a very distinct character. It is a bulbous plant, and is propagated by removing the offsets, which may be done in spring, potting them

singly in 6-inch pots. It requires good loamy soil, with sand enough to keep the compost open, and should have a good supply of water and a temperature of 65° to 70° during the night, with a rise of 8° or 10° in the day. During summer, growth is to be encouraged by repotting, but the plants should afterwards be slightly rested by removal to a night temperature of about 60°, water being withheld for a time, though they must not go too long dry, the plant being an evergreen. By the turn of the year they may again have more heat and more water, and this will probably induce them to flower. After this is over they may be shifted and

FIG. 145.—*Rucharis amazonica*.

grown again as before. As the specimens get large, they can either be divided to form new plants or allowed to develop into nobler specimens. With a stock of the smaller plants to start them in succession, this may be had in flower all the year round.

Gloxinia (fig. 146).

—The gloxinia, a charming decorative plant, may be grown much in the same way as the achimenes. A good strain of seed

FIG. 146.—*Gloxinia*.

will produce many superb and charmingly coloured varieties, and if sown early in spring, in a temperature of 65° at night, they may be shifted on into 6-inch pots, and in these may be flowered during the summer. The bulbs are kept at rest through the winter in dry sand, in a temperature of 50° , and to yield a succession should be started at intervals, say at the end of February and the beginning of April. To prolong the blooming season, use weak manure water when the flower-buds show themselves.

Lantana.—These are very ornamental stove shrubs, which can be utilized in the flower garden or greenhouse in summer. They are



FIG. 147.—*Lantana*, varieties.

increased by cuttings of the young shoots in heat, in the early spring, and should be grown in a free and tolerably rich compost of loam and peat, being stopped from time to time to secure bushy

growth. They come into flower towards the end of summer or earlier, according to the time of stopping, and continue flowering in the stove for a considerable period, producing their verberna-like heads of bright-coloured flowers in profusion. A group of them is shown at fig. 147.

The varieties are continually changing. Some of the more useful are *La Neige* and *Victoire*, white; *Pluie d'Or*, *Globe d'Or*, and *Californie*, yellow; *Meteore*, yellow passing to rose; and *Magenta King*, rosy scarlet.

Poinsettia.—The *Poinsettia pulcherrima*, with its brilliant scarlet bracts, stands unrivalled amongst decorative plants. The white-bracted sort, *P. p. alba*, is not so effective, but the double-flowered *P. p. plenissima*, in which the cymose inflorescence is branched, is as brilliant as the type, and keeps long in flower. They are increased by cuttings in spring, which when taken off with a heel strike freely in a brisk heat. They require good turfy loam, with an addition of one-sixth of leaf-mould and a little sand, and should be kept in a heat of from 65° to 70° at night, with a rise of 10° by day. To prevent their growing lanky, they should be kept with their heads almost touching the glass; and as the pots get filled with roots they must be shifted into others, the last being 8 inches or 10 inches in diameter. About August they may be inured to a heat of 50° at night, and should be brought to bear air night and day whilst the weather is warm, or they may be placed out of doors for a month under shelter of a



FIG. 148.—Tydaea.

south wall in the full sun. This treatment matures and prepares them for flowering. In autumn they must be removed to a house where the temperature is 50° at night, and by the end of September some of them may be put in the stove, where they will come into flower, the remainder being placed under heat later for succession.

When in bloom they may be kept at about 55° by night, and so placed will last longer than if kept in a higher temperatura.

Tydaea (fig. 148).—These handsome plants, which have sprung from the beautiful *Achimenes picta*, require similar treatment to achimenes, except that the winter bloomers must be started into growth at a different season, namely, the later spring months, as April and May. The summer-blooming sorts, which should be started earliest, should, as they come into flower, be removed to the conservatory. The autumn and winter flowering sorts, being at first grown slowly in a gentle heat, must as they show flower have a nice growing temperature of 70° or 75° afforded them with abundance of light; manure water may be given once a week. The tubers should be stored away dry after flowering.

ORCHIDS.

For the successful cultivation of a mixed collection of tropical orchids, it is necessary that two or three houses, in which different temperatures can be maintained, should be provided. The greater number of them are epiphytes or air plants, and heat and moisture afford all or nearly all the nourishment they require. The plants themselves are the better for being associated with such objects as ferns and palms, and the appearance of the houses is greatly improved by their being thus grouped.

The East Indian orchid house takes in those species which are found in the warm parts of the eastern hemisphere, as well as those from the hottest parts of the western, and its temperature should range from about 75° to 85° during the summer or growing season, and from 65° to 70° during winter. The Mexican or Brazilian orchid house accommodates the plants from the warm parts of South America, and its temperature should range from about 65° to 75° during summer, and from 60° to 65° in winter. A structure called the cool orchid house is set apart for the accommodation of the many lovely mountain species from South America and India, such as *odontoglossums*, *masdevallias*, &c., and in this the more uniform the temperature can be kept the better, that in summer varying between 60° and 70°, and in winter from 45° to 60°. A genial moist atmosphere must be kept up in the hottest houses during the growing season, with a free circulation of air admitted very cautiously by well-guarded ventilators. In winter, when the plants are at rest, little water will be necessary; but in the case of those plants which have no fleshy pseudobulbs to fall back upon for sustenance, they

must not be suffered to become so dry as to cause the leaves to shrivel. In the Mexican house the plants will generally be able to withstand greater drought occasionally, being greatly assisted by their thick pseudobulbs. In the cool or odontoglossum house a considerable degree of moisture must be maintained at all times, for in these the plants keep growing more or less continuously.

For potting or basketing purposes, or for plants requiring block-culture, the only materials admissible are light fibrous peat and living sphagnum moss, which supply free drainage for the copious supply of water required. The water should, however, be so used as not to run down into the sheathing bases of the leaves. While in flower, orchids may with advantage be removed to a drier and cooler situation, and may be utilized in the drawing-room or boudoir.

From amongst the great wealth of tropical orchids, now in cultivation, the following is a very limited selection of some of the most useful :—

Ada.—Epiphytal : *A. aurantiaca*.

Aerides.—Epiphytal : *A. affine*, *crassifolium*, *crispum*, *Fieldingii*, *Lobbii*, *nobile*, *odoratum*, and *suavisimum*.

Angræcum.—Epiphytal : *A. sesquipedale*, *eburneum*, and *citratum*.

Anguloa.—Terrestrial : *A. Clowesii* and *Ruckeri*.

Barkeria.—Cool epiphytal : *B. elegans*, *Skinneri*, and *spectabilis*.

Bollea. — Epiphytal :

B. Backhousiana, *cœlestis*, *Lalindel*, and *Patini*.

Calanthe. — Terrestrial : *C. Masuca*, *Veitchii*, and *vestita*.

Cattleya.—Epiphytal : *C. amethystoglossa*, *bulbosa*, *Dowiana*, *exoniensis*, *gigas*, *labiata*, *lobata*, *Mossii* (fig. 149), *quadricolor*, *Skinneri*, *superba*, and *Trianæ*.

Cœlogyne. — Epiphytal : *C. barbata*, *cristata*, *Gardneriana*, *Lowii*, *pandurata*, and *speciosa*.

Cymbidium.—Terrestrial : *C. eburneum*, *Lowianum*, and *Mastersii*.

Cypripedium. — Terrestrial : *C. Argus*, *barbatum superbum*, *caudatum*, *concolor*, *Dayanum*, *Har-*



FIG. 149.—*Cattleya Mossii*.

risianum, insigne Maulei, lævigatum, Lowii, niveum, Schlimmi, Stonel, and superbiens.

Dendrobium.—Epiphytal: *D. aggregatum majus*, Ainsworthii, barbatulum

Bensoniæ, chrysotis chrysotoxum, crasinode, crystallinum, Devonianum, Falconeri, fimbriatum oculatum, formosum giganteum lituliflorum, nobile, Paxtoni, pulchellum, suavissimum, and Wardianum.

Dendrochilum.—Epiphytal: *D. filiforme* and *glumaceum*.

Diaa.—Cool terrestrial: *D. grandiflora* and *Barrellii*.

Epidendrum. — Epiphytal: *E. dichromum*, *Frederici Guillelmi*, *ibaguense*, *macrochilum*, *memorale majus*, *vitellinum* (fig. 150), and *vitellinum majus*.

Lælia.—Epiphytal: *L. anceps*, *autumnalis*, *cinnabarina*, *elegans*, *harpophylla*, *majalis*, *Perrinii*, *purpurata*, and *superbiens*.

Limatodes. — Terrestrial: *L. rosea*.

Lycaste.—Cool epiphytal: *L. Skinneri*, with its many variations.

Masdevallia. — Cool epiphytal: *M. Davisii*, *Harryana*, *ignea*, *Lindeni*, *tovarensis*, and *Veitchiana*.

Mesopitridium.—Cool epiphytal: *M. sanguineum* and *vulcanicum*.

Miltonia.—Epiphytal: *M. spectabilis*, with its fine variety *Moreliana*.

Odontoglossum.—Cool epiphytal: *O. Alexandræ (crispum)*, *Andersonianum*, *citrosimum*, *cirrhosum*, *grande*, *Hallii*, *Inaleayi*, *membranaceum*, *Pescatorei*, *Phalenopsis*, *Rossii* (fig. 151), *Roezlii*, *triumphans*, *Uro-Skinneri*, and *veixillarium*.



FIG. 150.—*Epidendrum vitellinum*.



FIG. 151.—*Odontoglossum Rossii*.

Oncidium.—Epiphytal : *O. ampliatum* majus, *Barkeri*, *crispum*, *cucullatum*, *curtum*, *macranthum*, *Marshallianum*, *ornithorrhynchum*, *roseum*, *Papilio* *majus*, *sarcodes*, and *varicosum* *Rogersii*.

Pescatoria.—Epiphytal : *P. Dayana*, *lamellosa*, *Roetzlii*, and *Wallisii*.

Phajus.—Terrestrial : *P. grandifolius* and *Wallichii*.

Phalenopsis.—Epiphytal : *P. amabilis*, *grandiflora*, and *Schilleriana*.

Pleione (Indian Crocus).—Epiphytal : *P. Hookeriana*, *humilis*, *lagenaria*, *maculata*, *præcox*, *Reichenbachiana*, and *Wallichiana*.

Renanthera.—Epiphytal : *R. coccinea* and *Lowii*.

Saccolabium.—Epiphytal : *S. ampullaceum*, *Blumei* *majus*, *curvifolium*, *guttatum*, *miniaturum*, *præmorsum*, and *retusum*.

Sobralia.—Terrestrial : *S. macrantha* *splendens*.

Sophronitis.—Epiphytal : *S. grandiflora*.

Stanhopea.—Epiphytal : *S. grandiflora*, *insignis*, *oculata*, and *tigrina*.

Thunia.—Terrestrial : *T. alba* and *Bensoniæ*.

Trichopilia.—Epiphytal : *T. crispa*, *marginata*, *suavis*, and *tortilis*.

Vanda.—Epiphytal : *V. Cathcartii*, *cœrules*, *cœrulescens*, *gigantea*, *suavis*, *teres* *Andersoni*, and *tricolor*.

Zygopetalum.—Epiphytal : *Z. Gautieri*, *Mackayi*, *maxillare*, and *rostratum*.

PALMS.

These noble plants while quite young, form charming ornaments for the drawing-room and the dinner table. When more fully developed, and long before their full growth is attained, they are among the best ornamental foliaged conservatory plants. For the most part they are stove plants (75° to 80°), but after the growth is matured, many of them thrive for some time in the temperature of a dwelling house. They are of very easy cultivation, but require plenty of water and thorough drainage. The soil should consist of equal parts of loam, peat, and vegetable mould, with abundance of sand, and they thrive best in comparatively small pots. The species are mostly either fan-leaved (fig. 152) or pinnate (fig. 153).

The following is a selection of useful species :—

Acanthophaenix.—Pinnate : *A. crinita* and *Herbstii*.

Acanthorrhiza.—Fan-leaved : *A. stauracantha* and *Warszewiczii*.

Areca.—Pinnate : *A. alba*, *aurea*, *lutescens*, and *rubra*.

Astrocaryum.—Pinnate : *A. acaule*, *Murumuru*, and *rostratum*.

Attalea.—Pinnate : *A. funifera*, *nucifera*, and *speciosa*.

Bactris.—Pinnate : *B. baculifera*, *integrifolia*, and *simplicifrons*.

Brahea.—Fan-leaved : *B. filamentosa* (a Californian species, having the edges of the leaf-segments developed into long threadlike pendent filaments) and *B. Roetzlii*.

Calamus.—Pinnate, and exceedingly handsome as young plants, but afterwards assuming the habit of climbers : *C. adspersus*, *aspermus*, *ciliaris*, *flagellum*, *Impératrice* *Marie*, *Jenkinsianus*, *melanochætes*, *palembanicus*, *plumosus*, and *viminalis*.

Caryota.—Pinnate : *C. Cumingii* is the dwarfest of the species, bipinnate, the leaves from 3 to 6 feet long ; *C. urens*.

Cerozylon.—Pinnate: *C. andicola* is a majestic species.

Chamædorea.—Pinnate, and well suited for indoor decoration during the winter months: *C. Arenbergiana*, *desmoncoides*, *elegans*, *Ernesti-Augusti*, *glaucifolia*, *graminifolia*, *microphylla*, and *Warszewiczii*

Chamærops.—Fan-leaved, comparatively dwarf, and admirably adapted



FIG. 152.—*Chamærops Griffithii*.

for decoration: *C. Griffithii* (fig. 152), *excelsa*, *Fortunei*, *humilis*, and *Martiana*.

Cocos.—Pinnate: Shade-loving plants, some of which are most charming, especially *C. Bonneti*, *coronata*, *elegantissima*, *flexuosa*, *plumosa*, and *Weddelliana* (fig. 153).

Cyphokentia.—Pinnate: *C. gracilis* and *macrocarpa* (*Kentia* Linden).

Euterpe. — Pinnate:

E. edulis.

Geonoma.—Pinnate: Small - growing and nearly all very handsome while young, especially *G. congesta*, *elegans*, *gracilis*, *macrostachys*, *Martiana*, *Porteana*, *pumila*, and *Schottiana*.

Hyophorbe.—Pinnate: *H. amaricaulis*, *indica*, and *Verschaffeltii*.

Jubæa.—Pinnate: the Chilian *J. spectabilis* is highly decorative, and may be grown in the open during summer.

Kentia.—Pinnate: *K. Baueri*, *Belmoreana*, *Fosteriana*, *sapida*, and *Wendlandiana* are ornamental greenhouse palms.

Latania.—Fan-leaved: *L. aurea*, *Commersoni*, and *rubra*.

Licuala.—Fan-leaved: *L. acutifida*, *elegans*, and *peltata*.

Livistonia.—Fan-leaved, and of very robust constitution: *L. altissima*, *australis*, *Hoogendorpii*, *olivæformis*, and *sinensis* (*Latania borbonica*).

Malortica.—Pinnate, dwarf elegant palms, well adapted for table decoration: *M. gracilis* and *simplex*.

Martinezia.—Pinnate, with singular erose leaflets: *M. erosa*, *granatensis*, and *Lindeniana*.

Oncosperma. — Pinnate: *O. Van Houtteanum*, a splendid plant for exhibition purposes.

Oreodoxa.—Pinnate, and while young beautiful as table plants, standing



FIG. 153.—*Cocos Weddelliana*.



FIG. 154.—*Phoenix rupicola*.

long in a room without sustaining any injury : *O. oleracea* and *regia*.

Phœnicophorium. — Entire-leaved, magnificent ornaments in the stove : *P. sechellarum*, known also as *Stevensonia grandiflora*.

Phœnix. — The Date Palm of commerce, *P. dactylifera*, although common, is extremely ornamental, and so hardy that it may be used in almost any situation during the summer months ; other fine sorts are *P. reclinata*, *rupicola* (fig. 154), *sylvestris*, and *tenuis*.

Prætorchardia. — Fan-leaved : *P. aurea*, *grandis*, *macrocarpa*, *Martiana*, and *pacifica*.

Ptychosperma. — Pin-nate, and of robust constitution : *P. Alexandræ*, *Cunninghamii* (*Seaforthia elegans*), and *rupicola*.

Rhapis. — Fan-leaved slender-stemmed, and of hardy constitution : *R. flabelliformis* and *humilis*.

Sabal. — Fan-leaved, noble plants reaching gigantic proportions : *S. Blackburniana* and *umbraculifera*.

Thrinax. — Fan-leaved, with slender stalks and leaves much divided ; peculiarly light and elegant for table or other decoration ; *T. arborea*, *argentea* (fig. 155), *barbadensis*, *elegans*, *graminiflora*, *multiflora*, *parviflora*, and *radiata*.

Trithrinax. — Fan-leaved : *T. mauritiæformis*.

Verschaffeltia. — Entire-leaved, in the way of *Phœnicophorium*, and requir-



FIG. 155.—*Thrinax argentea*.



FIG. 156.—*Verschaffeltia splendida*.

ing strong moist heat: *V. melanochætes* and *splendida* (*Regelia majestica*, fig. 156) are remarkable for their long needle-like black spines.

Welfia.—Pinnate: *W. regia*.

FERNS.

These popular plants are usually increased by means of their spores, the "dust" produced on the back of their fronds. The spores should be sown in well-drained pots or seed pans on the surface of a mixture of fibrous sifted peat and small broken crocks or sandstone; this soil should be firmly pressed and well-watered, and the spores scattered over it, and at once covered with propagating glasses or pieces of sheet glass, to prevent water or dry air getting to the surface. The pots should be placed in pans full of water, which they will absorb as required. A shady place is desirable, with a temperature of 50° to 55° by night and 65° to 70° by day, or they may be set on a shelf in an ordinary propagating pit. The spores may be sown as soon as ripe, and when the young plants can be handled, or rather can be lifted with the end of a pointed flat stick, they should be pricked out into well-drained pots or pans filled with similar soil, and should be kept moist and shady. As they become large enough, pot them singly in 3-inch pots, and when the pots are fairly filled with roots shift on into larger ones.

The best time for a general repotting of ferns is in spring, just before growth commences. Those with creeping rhizomes can be propagated by dividing these into well-rooted portions, and, if a number of crowns is formed, they can be divided at that season. In most cases this can be performed with little risk, but the *gleichenias*, for example, must only be cut into large portions, as small divisions of the rhizomes are almost certain to die; in such cases, however, the points of the rhizomes can be led over and layered into small pots, several in succession, and allowed to remain unsevered from the parent plant until they become well-rooted. In potting the well-established plants, and all those of considerable size, the soil should be used in a rough turfy state, not sifted but broken, and one-sixth of broken crocks or charcoal and as much sand as will insure free percolation should be mixed with it.

The stove ferns require a day temperature of 65° to 75°, but do not thrive in an excessively high or close dry atmosphere. They require only such shade as will shut out the direct rays of the sun, and, though abundant moisture must be supplied, the atmosphere should not be loaded with it. The water used should always be at

or near the temperature of the house in which the plants are growing. Some ferns, as the different kinds of *Gymnogramma* and *Cheilanthes*, prefer a drier atmosphere than others, and the former do not well bear a lower winter temperature than about 60° by night. Most other stove ferns, if dormant, will bear a temperature as low as 55° by night and 60° by day from November to February. About the end of the latter month the whole collection should be turned out of the pots and redrained, or repotted into larger pots as required. This should take place before growth has commenced. Towards the end of March the night temperature may be raised to 60°, and the day temperature to 70° or 75°, the plants being shaded in bright weather. Such ferns as *Gymnogrammas*, which have their surface covered with golden or silver powder, and certain species of scaly-surfaced *Cheilanthes* and *Nothochlæna*, as they cannot bear to have their fronds wetted, should never be syringed; but most other ferns may have a moderate sprinkling occasionally (not necessarily daily), and as the season advances, sufficient air and light must be admitted to solidify the tissues.

Space will only permit that we should append a list of choice ferns, which, however, might be much extended. We shall arrange them under the heads of stove, greenhouse, and hardy.

Select Stove Ferns.

Acrophorus affinis, *charophyllus*, and *immersus* (*Leucostegia*).

Acrostichum aureum.

Adiantum *semulium*, *cardioclæna*, *caudatum*, *concinnum*, *cristatum*, *cuneatum*, *curvatum*, *farleyense* (fig. 157), *gracillimum*, *Henalovianum*, *lunulatum*, *macrophyllum*, *mundulum*, *peruvianum*, *polyphyllum*, *princeps*, *pulverulentum*, *Seemannii*, *subcordatum*, *tenerum*, *trapeziforme*, *Veitchianum*, *villosum*, and *Williamsii*.

Alsophila *armata*, *aspera*, *glauca*, *philippensis*, *pruinata*, *pyncocarpa*, *radens*, and *Tænitis*.

Aglaomorpha *Meyeniana*.

Anemia *adiantifolia*, *cheilanthoides*, *collina*, and *mandioccana*.

Anemidietyon *Phyllitidis*, and its several forms—*fraxinifolium*, *laciniatum*, *longifolium*, and *tessellatum*.

Aspidium *trifoliatum*.

Asplenium *alatum*, *caudatum*, *cicutarium*, *erectum*, *Fabianum*, *ferulaceum*, *formosum*, *heterocarpum*, *horridum*, *laserpitilifolium*, *longissimum*, *myriophyllum*, *neo-caledonicum*, *planicaule*, *rachirhizon*, *rhizophorum*, *Viellardi* (*schizodon*), *serra*, *Veitchianum* (*Belangeri*), and *viviparum*.

Blechnum *brasiliense*, *gracile*, *Lanceola*, *longifolium*, *occidentale*, and *orientale*.

Campyloneurum *lucidum*, *repens*, *nitidum*, and *decurrens*.

Ceratopteris *thallictroides*, an aquatic sub-annual species with proliferous sterile fronds.

Cheilanthes Borsigiana, cuneata, elegans, farinosa, frigida, pulveracea, radiata, spectabilis, and viscosa.

Cibotium Barometz, Chamissoi, glaucum Menziesii, pruinosa, regale, and Schledel.

Cionidium Moorei.

Cyathea arborea, canaliculata, excelsa, insignis (*Cibotium princeps*), and serra.

Davallia aculeata, bullata, dissecta, divaricata (polyantha), elata, elegans, filiensis, Mooreana, ornata, pentaphylla, solida, and tenuifolia.

Dennstaedtia cicutaria.



FIG. 157.—*Adiantum farleyense*.

Deparia prolifera.

Dicksonia chrysotricha.

Dictyosiphium panamense.

Didymochlena lunulata.

Diplazium alternifolium, celtidifolium, grandifolium, Shepherdii, striatum, sylvaticum, and zeylanicum.

Doryopteris collina, nobilis, palmata, and sagittifolia.

Drynaria coronans, diversifolia, morbillosa, and quercifolia.

Elaphoglossum cuspidatum, L'Herminieri, scolopendrifolium, squamosum, and numerous other species.

Gleichenia dichotoma, furcata, pectinata, and pubescens

Goniophlebium appendiculatum, colpodes, lachnopus, Lepidopteris, loricum, squamatum, subauriculatum, and verrucosum.

Goniopteris asplenoides, crenata, Ghiesbreghtii, refracta, and reptans

Gymnogramma chrysophylla and its variety *Parsonsi*; flexuosa, L'Hermieri, Pearcei, peruviana and its variety *argyrophylla*; pulchella, sulphurea, tartarea, trifoliata, and Wettenhalliana.

Hemitelia grandifolia, horrida, Karsteniana, and speciosa.

Humata alpina, heterophylla, and pedata.

Hymenodium crinitum.

Hymenophyllum, any of the species.

Hymenostachys elegans.

Hypolepis repens.

Lastrea augescens, deltoidea, patens, recedens, and strigosa (crinita).

Lindsæa cultrata, gulanensis, and trapeziformis.

Litobrochia aurita, denticulata, macroptera, podophylla, and tripartita.

Lomaria attenuata, fraxinifolia, L'Hermieri, and onocleoides.

Lygodictyon Forsteri.

Lygodium flexuosum, venustum, and volubile.

Microlepia hirta cristata.

Nephrodium articulatum, cyatheoides, Hookeri, pteroides, truncatum, unitum, and venustum.

Nephrolepis davallioides and its variety *furcans*; Duffii, ensifolia, exaltata pectinata, pluma, tuberosa, and undulata.

Niphobolus costatus, Gardneri, and pertusus.

Nothochlæna flavens, nivea, rufa, sinuata, and trichomanoides.

Oleandra articulata, nerififormis, and nodosa.

Olfersia cervina.

Onychium auratum.

Osmunda palustris (evergreen).

Phlebodium areolatum, aureum, pulvinatum, and sporocarpium.

Platycerium alcorni and its variety *majus*; biforme, grande, Hillii, Stemmaria, Wallichii, and Willinckii.

Pleocnemia Leuzeana.

Pleopeltis albo-squamata, incurvata, lelorrhiza, longissima, and Phymatodes.

Polypotrya caudata and osmundacea.

Polypodium Dianæ, Paradisæ, pectinatum, and Schkuhrii.

Polystichum conifolium, denticulatum, lentum, ordinatum, triangulum, and viviparum.

Pteris argyrea, aspericaulis, longifolia, quadriaurita, semipinnata, tricolor, serrulata and its many varieties.

Sadleria cyatheoides.

Sagenia cicutaria, Lawrenceana, macrophylla, Pica, and repanda.

Schizæa dichotoma and elegans.

Stenosemia aurita.

Thamnopteris australasica and Nidus.

Thyrsopteris elegans.

Trichomanes, any of the species.

Select Greenhouse Ferns.

Acrophorus hispidus (*Davallia novæ-zelandiæ*).

Adiantum affine, assimile, cuneatum, decorum, excisum and its variety *multifidum*; *formosum*, *glaucophyllum*, *hispidulum*, *reniforme*, and *sulphureum*.

Alsophila australis, capensis, excelsa, and Leichardtiana.

Asplenium appendiculatum, bulbiferum, Colensoi, compressum, dimorphum, Dregeanum, flabellifolium, flaccidum, Hemionitis (palmatum), lucidum, monanthemum, obtusatum, polyodon, and præmorsum.

Balanium Culcita.

Blechnum australe and serrulatum.

Ceterach aureum.

Cheilanthes alabamensis, argentea, capensis, fragrans, hirta Ellisiana, micromera, microphylla, pteroides, and tenuifolia.

Cyathea Burkel, Cunninghamii, dealbata, Dregel, medullaris, and Smithii.

Cyrtomium caryotideum, falcatum, and Fortunei.

Davallia canariensis, Marlesii, and pyxidata.

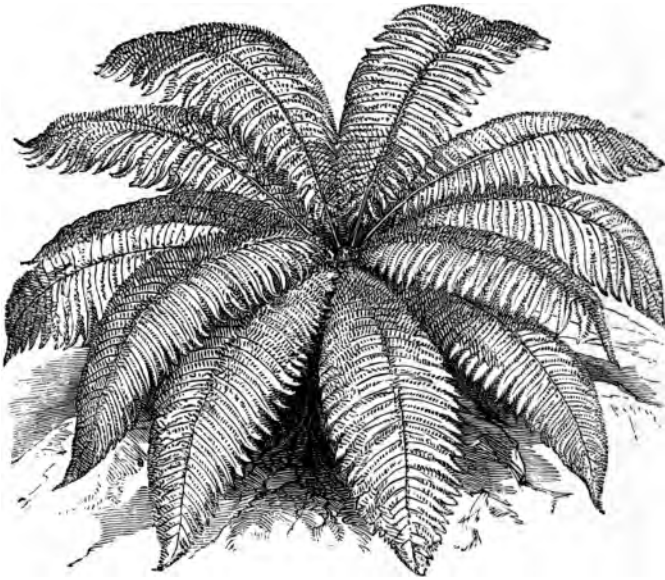


FIG. 158.—*Todea superba.*

Dennstaedtia davallioides, Youngii.

Dicksonia antarctica, Berteroana, Sellowiana, squarrosa, and Youngii.

Doodia aspera and its varieties *multifida* and *corymbifera*; *blechnoides*, *caudata* and its variety *confuens*; and *media*.

Gleichenia circinata and its variety *glauca*; *Cunninghamii*, *dicarpa*, *flabellata*, *hectistophylla*, *rupestris*, *semivestita*, and *Speluncæ*

Humata Tyermanni.

Hymenophyllum seruginosum, crispatum, cruentum, demissum, dilatatum, flabellatum, flexuosum, fuciforme, polyanthos, pulcherrimum, and scabrum.

Hypolepis Bergiana, distans. Millefolium. and tenuifolia.

Lastrea aristata variegata, *decomposita*, *decurrens*, *elongata*, *erythrosora*, *glabella*, *hispida*, *laserpitilifolia*, *Sieboldii*, and *varia*.

Litobrochia comans, *macilentia*, and *vespertilionia*.

Llavea cordifolia.

Lomaria australis, *blechnoides*, *capensis*, *ciliata*, *discolor* and its variety *bipinnatifida*; *dura*, *fluviatilis*, *Fraseri*, *gibba* and its variety *Bellii*; *Gilliesii*, *lanceolata*, *magellanica*, *nuda*, *obtusata*, *Patersoni*, and *procera*.

Loxsuma Cunninghamii.

Microlepia cristata, *platyphylla*, *scabra*, and *strigosa*.

Niphobolus heteractis, *Lingua*, and *rupestris*.

Nothochlæna canariensis, *Eckloniana*, *lævis*, *lanuginosa*, and *Marantæ*.

Platyloma atropurpureum, *bellum*, *Brownii*, *Calomelanos*, *cordatum*, *falcatum*, *flexuosum*, and *rotundifolium*.

Pleopeltis Billardieri and *pustulata*.

Polystichum capense, *falcinellum*, *frondosum*, *lepidocaulon*, *proliferum*, *tripteron*, *venustum*, and *vestitum*.

Pteris arguta, *crenata*, *cretica albo-lineata*, *hastata*, *Kingiana*, *longifolia*, *sempinnata*, *serrulata* and its many garden sports (*angustata*, *Applebyana*, *corymbifera*, *cristata*, *cristata variegata*, *Goeziana*, *polydactyla*, *semifastigiata*, *Leyi*, and *fimbriata*), *tremula*, and *umbrosa*.

Todea barbara (*africana*), *Fraseri*, *hymenophyllioides* (*pellucida*), and *superba* (fig. 158).

Trichomanes elongatum, *reniforme*, and *venosum*.

Woodisia mollis.

Woodwardia orientalis, and *radicans* with its variety *cristata*.

Select Hardy Ferns.

Adiantum Capillus-Veneris and the varieties *incisum*, *magnificum*, and *cornubiense*; and *pedatum*. *A. Capillus-Veneris Lûddemannianum* (fig. 159) is a remarkable *cristata* variety.

Allosorus crispus.

Asplenium Adiantum-nigrum and the variety *grandiceps*; *alternans*, *angustifolium*, *ebeneum*, *fontanum*; *lanceolatum* and the variety *microdon*; *marinum* and the varieties *ramosum*, *trapeziforme*, *subbiplnnatum*, and *crenatum*; *Trichomanes* and the varieties *incisum*, *Moulei*, *ramosum*, *multifidum*, and *cristatum*.

Athyrium Filix-fœmina and the varieties *corymbiferum*, *crispum*, *Frizellise*, *Applebyanum*, *grandiceps*, *plumosum*, *Victoriæ*, *apiculatum*, *acrocladon*, *apueforme*, *coronatum*, *Elworthii*, *gracillimum*, *Grantiæ*, *marinum*, *multiceps*, *multifidum*, *polyclados*, *polydactylon*, *thyssanotum*, &c.; and *Gorin-gianum pictum*.

Blechnum Spicant and the varieties *imbricatum*, *multifurcatum*, *ramosum*.

Camptosorus rhizophyllus.

Ceterach officinarum.

Cyrtomium falcatum.

Cystopteris bulbifera, *fragilis* and the varieties *angustata* and *Dickleana*; *montana*, and *sudetica*.

Dennstaedtia punctilobula (*Dicksonia pilosiuscula*).

Dictyogramma japonica.

Diplazium lanceum and *thelypteroides*.

Gleichenia alpina.

Hymenophyllum tunbridgense and *unilaterale*.

Lastrea æmula (*foenlicelli*), *atrata*, *cristata*; *dilatata* and its varieties

Chanterlæ, *dumetorum*, *lepidota*; *erythrosora*; *Filix-mas* and the varieties *Bollandiæ*, *cristata*, *cristata angustata*, *grandiceps*, *paleacea*, *Pinderi*; *Goldieana*, *marginalis*; *montana* and the varieties *crispa*, *cristata*, *Nowelliana*; *noveboracensis*, *remota*, *rigida*, *spinulosa*, and *Thelypteris*.

Lomaria alpina and *chilensis*.

Lygodium palmatum.

Nothochlæna Marantæ and *vestita*.

Onoclea sensibilis.



FIG. 159.—*Adiantum Capillus-Veneris* Lueddemannianum.

Onychium lucidum (*japonicum*).

Osmunda cinnamomea, *spectabilis*, *gracilis*, *Claytoniana* (*interrupta*), *regalis* and its variety *cristata*.

Polypodium alpestre and its variety *flexile*; *Dryopteris*, *Krameri*, *Phegopteris*, *Robertianum* (*calcareum*), *vulgare* and its varieties *cambricum*, *cristatum*, *omnilacerum*, *pulcherrimum*, *semilacerum*, and *cornubiense*.

Polystichum acrostichoides; *aculeatum* and its varieties *lobatum*, *multifidum*, *acrocladon*, &c.; *angulare* and its varieties *cristatum*, *grandiceps*, *Holeanæ*, *parvissimum*, *Pateyi*, *polydactylum*, *proliferum*, *proliferum* Wol-

lastoni, rotundatum, grandidens, imbricatum, plumosum, Kitsoniæ, pterophorum, tripinnatum, &c. ; falcinellum, Lonchitis, and setosum.

Pteris aquilina, cretica albo-lineata, and scaberula.

Scolopendrium vulgare and its varieties acrocladon, Claphamii, columnare, Coolingii, crispum, crispum fertile, crispum minus, crispum latum, cristatum, laceratum, marginatum, multifidum, Stansfieldii, and many others.

Struthiopteris germanica, japonica, and pennsylvanica.

Trichomanes radicans.

Woodsia alpina, ilvensis, obtusa, and polystichoides Veitchii.

Woodwardia areolata, japonica, and virginica.



CHAPTER VII.

FRUITS.



No pains should be spared, in the preparation of Fruit Tree Borders, to secure their thorough drainage. The soil is sometimes placed upon a pavement flooring supported by stone or brick piers, with a cavity below of 18 inches or 2 feet deep, into which air is admitted by small vertical shafts, placed along the edges of the walk, and covered with open iron gratings. This arrangement is expensive, and the same advantages can generally be secured by placing over the sloping bottom a good layer of coarse rubbly material, communicating with a drain in front to carry off the water, while earthenware drain tubes may be laid beneath the rubble from 8 to 10 feet apart, so as to form air drains, and provided with openings both at the side of the walk and also near the base of the wall. Over this rubbly matter, rough turfy soil, grass-side downwards, should be laid, and on this the good prepared soil in which the trees are to be planted. Such an elaborate system of drainage is, however, necessary only in the case of adhesive clayey subsoils.

The borders should consist of three parts rich turfy calcareous loam, the top spit of a pasture, and one part light gritty earth, such as road-grit, with a small portion (one-sixth) of old lime and brick rubbish. They should not be

less than 12 feet in breadth, and may vary up to 15 or 18 feet, with a fall from the wall of about 1 inch in 3 feet. The border itself should be raised a foot or more above the general level. The bottom of the border must slope evenly to the drain, which must be kept lower than the general level of the subsoil, else the soakage will gather in all the little depressions of its surface. Fruit-tree borders should not be cropped with vegetables, or very slightly so, as the process of digging destroys the roots of the trees, and drives them from near the surface, where they ought to be.

Shallow planting, whether of wall trees or standards, is generally to be preferred, a covering of a few inches of soil being sufficient for the roots, but a surface of at least equal size to the surface of the hole should be covered with dung or litter so as to restrain evaporation and preserve moisture. In the case of wall trees, a space of about 6 inches is usually left between the stem at the insertion of the roots and the wall, to allow for increase of girth. Young standard trees should be tied to stakes so as to prevent their roots being ruptured by the wind-waving of the stems.

In the selection and distribution of fruit trees regard must of course be had to local situation and climate. The best walls having a south or south-east aspect are allotted to the peach, apricot, and fig. Cherries and the generality of plums succeed very well either on an east or a west aspect. In Scotland the mulberry requires the protection of a wall, and several of the finer apples and pears do not arrive at perfection without this help, and a tolerably good aspect. The wall-trees intended to be permanent are called dwarfs, from their branches springing from near the ground. Between these, trees with tall stems, called riders, are planted as temporary occupants of the upper part of the

wall. The riders should have been trained in the nursery into good-sized trees, in order that when planted out they may come into bearing as speedily as possible.

Standard Fruit Trees should not be planted, if it can be avoided, in the borders of the kitchen garden, but in the outer slips, where they may be allowed to attain their full size. In the open garden all fruit trees should be kept dwarfed. Each sort of fruit should be planted by itself, for the sake of orderly arrangement, and in order to facilitate protection when necessary. Their produce is often superior in flavour to that of the same kind of fruit grown on walls.

The *Almond*, *Amygdalus communis*, is very ornamental in respect to its flowers in the early spring months, but of little value for its fruit. There are two varieties, one producing large flowers and sweet-kernelled fruits, and the other small flowers and bitter kernels. Every good garden should contain a tree or two, especially of the sweet almond, for their ornamental aspect in spring. The almond requires a warm light soil, well drained, and a sheltered position and warm aspect. It is propagated by budding on the seedling almond, or for heavier soils on the plum stock.

The *Apple*, *Pyrus Malus*, is amongst the most useful of all our hardy fruits, and succeeds in localities too cold for either the pear or the plum, while from its flowering later in the spring it is less liable to be cut off by frosts. It may be propagated by seeds (pips) to obtain new sorts, or by grafting to perpetuate established kinds, the French paradise stock being preferred for dwarfed or bush trees, and the crab or free stock (from pips) for orchard trees; whip-grafting is preferred. The stocks should be at least as thick as the finger; and should be headed back to where the graft is to be fixed in January, unless the weather is frosty, but in any case before vegetation becomes active. The scions should be cut at the same time, or earlier, and laid in a trench, in contact with moist soil, until required.

The apple-tree will thrive in any good well-drained soil, the best being a good mellow calcareous loam, while the less iron there is in the subsoil the better. The addition of marl to soils that are not naturally calcareous very much improves them. The trees are liable

to canker in undrained soils or those of a hot sandy nature. Where the soil is not naturally rich enough, it should be well manured, but not to the extent of encouraging over-luxuriance. It is better to apply manure in the form of a compost than to use it in a fresh state or unmixed.

To form an orchard, standard trees should be planted at from 25 to 40 feet between the rows, according to the fertility of the soil and other considerations. The trees should be selected with clean, straight, self-supporting stems, and the head should be shapely and symmetrical, with the main branches well balanced. In order to



FIG. 160.—Bush Apple; Cox's Orange Pippin on English Paradise stock, 4 years old.

obtain such a stem, all the leaves on the first shoot from the graft or bud should be encouraged to grow, and in the second season the terminal bud should be allowed to develop a further leading shoot, while the lateral shoots should be allowed to grow, but so that they do not compete with the leader, on which the growth of leaves should also be encouraged in order that they may give additional strength to the stem below them. The side shoots should be removed gradually, so that the diminution of foliage in this direction may not exceed the increase made by the new branches and shoots of the

upper portion. Dwarf pyramids, which occupy less space than open dwarfs, if not allowed to grow tall, may be planted at from 10 to 12 feet apart. Dwarf bush trees may be planted from 10 to 15 feet apart, according to the variety and the soil. Dwarf bushes on the Paradise stock (figs. 160, 161) are both ornamental and useful in small gardens, the trees being always conveniently under control. These bush trees, which must be on the proper stock—the French Paradise—may be planted at first 6 feet apart, with the same distance between the rows, the space being afterwards increased, if desired, to 12 feet apart, by removing every alternate row.

“Cordons” are trees trained to a single shoot, the laterals of which are kept spurred. They are usually trained horizontally, at about $1\frac{1}{2}$ feet from the ground, and may consist of one stem (fig. 162), or of two (fig. 163), the stems in the latter case being trained in opposite directions. In cold districts the finer sorts of apples may be grown against walls as upright or oblique cordons. From these cordon trees on the French paradise very fine fruit may often be obtained. The apple may also be grown as an espalier tree, a form which does



FIG. 161.—Bush Apple; Dumelow's Seedling on Nonesuch Paradise stock.



FIG. 162.—Single Cordon Apple-tree.

not require much lateral space. The ordinary trained trees for espaliers and walls should be planted 20 feet apart.

The fruit of the apple is produced on spurs which form on the branchlets of two years old and upwards, and continue fertile for a series of years. The principal pruning should be performed in

summer, the young shoots if crowded being thinned out, and the superabundant laterals shortened by breaking them half through. The general winter pruning of the trees may take place any time from the beginning of November to the beginning of March, in open weather. The trees are rather subject to the attacks of the



FIG. 163.—Double Cordon Apple-tree.

American blight (*Eriosoma mali*), which may be removed by scrubbing with a hard brush, by painting the affected spots with any bland oil, or by washing them with dilute paraffin and soft soap.

The following are a few of the most approved varieties of the apple tree, arranged in the order of their ripening, with the months in which in ordinary seasons they are to be had in use. The selection might be varied to suit individual tastes, and might be much extended, but those here named can be safely recommended :—

Dessert Apples.

White Juneating	July.	Ribston Pippin	Nov.-Mar.
Early Red Margaret.....	Aug.	Golden Pippin	Nov.-Apr.
Irish Peach	Aug.	Golden Reinette	Nov.-Apr.
Devonshire Quarrenden ..	Aug., Sept.	Northern Spy	Nov.-Apr.
Duchess of Oldenburg....	Aug., Sept.	Rosemary Russet	Nov.-Apr.
Oslin	Aug., Sept.	Ashmead's Kernel.....	Nov.-May.
Red Astrachan	Sept.	Aromatic Russet	Dec.-Feb.
Kerry Pippin	Sept., Oct.	White Winter Calville } (grown under glass) .. }	Dec.-Mar.
Peasgood's Nonesuch	Sept., Oct.	Braddick's Nonparell ...	Dec.-Apr.
King of the Pippins	Oct.-Jan.	Court-pendu Plat	Dec.-Apr.
Cox's Orange Pippin	Oct.-Feb.	Wyken Pippin	Dec.-Apr.
Court of Wick	Oct.-Mar.	Cornish Gilliflower	Dec.-May.
Blenheim Pippin	Nov.-Feb.	Golden Harvey	Dec.-May.
Sam Young	Nov.-Feb.	Scarlet Nonparell	Jan.-Mar.
Sykehouse Russet.....	Nov.-Feb.	Cockle's Pippin	Jan.-May.
Fearn's Pippin	Nov.-Mar.	Lamb Abbey Pearmain ...	Jan.-May.
Herefordshire Pearmain ..	Nov.-Mar.	Old Nonparell	Jan.-May.
Mannington's Pearmain ..	Nov.-Mar.	Sturmer Pippin	Feb.-June.
Margil	Nov.-Mar.		

Kitchen Apples.

Keswick Codlin.....	Aug., Sept.	Gloria Mundi.....	Nov.-Jan.
Lord Suffeld.....	Aug., Sept.	Blenheim Pippin.....	Nov.-Feb.
Manks Codlin.....	Aug.-Oct.	Tower of Glammis.....	Nov.-Feb.
Ecklinville Seedling.....	Aug.-Nov.	Dumclow's Seedling.....	Nov.-Mar.
Stirling Castle.....	Aug.-Nov.	Alfriston.....	Nov.-Apr.
Stone's.....	Aug.-Nov.	London Pippin.....	Nov.-Apr.
Emperor Alexander.....	Sept.-Dec.	Northern Greening.....	Nov.-Apr.
Waltham Abbey Seedling.....	Sept.-Jan.	Reinette de Canada.....	Nov.-Apr.
Cellini.....	Oct., Nov.	Bess Pool.....	Nov.-May.
Gravenstein.....	Oct.-Dec.	Royal Russet.....	Nov.-June.
Hawthornden.....	Oct.-Dec.	Gooseberry.....	Nov.-July.
Baumann's Red Winter.....	Oct.-Jan.	Winter Greening.....	Nov.-July.
Reinette.....	Oct.-Jan.	Rhode Island Greening.....	Dec.-Apr.
Mère de Ménage.....	Oct.-Jan.	Rymer.....	Dec.-Apr.
Beauty of Kent.....	Oct.-Feb.	Lane's Prince Albert.....	Jan.-June.
Yorkshire Greening.....	Oct.-Feb.	Norfolk Beaufin.....	Jan.-June.

The *Apricot*, *Prunus Armeniaca* or *Armeniaca vulgaris*, is propagated by budding on the mussel or common plum stock. The tree succeeds in good well-drained loamy soil, rather light than heavy. It is usually grown as a wall tree, the east and west aspects being preferred to the south, which induces mealiness in the fruit, though in Scotland the best aspects are necessary. The most usual and best mode of training is the fan method in the modified form represented at page 168, under fig. 83. The fruit is produced on shoots of the preceding year, and on small close spurs formed on the two-year-old wood. The trees should be planted about 20 feet apart. The summer pruning should commence early in June, at which period all the irregular fore-right and useless shoots are to be pinched off; and, shortly afterwards, those which remain are to be fastened to the wall. At the winter pruning all branches not duly furnished with spurs and fruit buds are to be removed. The young bearing shoots are moderately pruned at the points, care being, however, taken to leave a terminal shoot or leader to each branch. The most common error in the pruning of apricots is laying in the bearing shoots too thickly; the branches naturally diverge in fan training, and when they extend so as to be about 15 inches apart, a fresh branch should be laid in, to be again subdivided as required. The blossoms of the apricot open early in spring, but though more hardy than those of the peach, the same means of protection when necessary may be employed for both. If the fruit sets too numerously, it is thinned out in June and in the beginning of July, the later thinnings being used for tarts. In

the south of England, where the soil is suitable, the hardier sorts of apricot, as the Breda and Brussels bear well as standard trees in favourable seasons. In such cases the trees may be planted from 20 to 25 feet apart.

Forcing.—The ripening of the fruit of the apricot may be accelerated by culture under glass, the trees being either planted out like peaches, or grown in pots on the orchard-house system. They must be very gently excited, since they naturally bloom when the spring temperature is comparatively low. At first a maximum of 40° only must be permitted; after two or three weeks it may be raised to 45°, and later on to 50° and 55°, and thus continued till the trees are in flower, air being freely admitted, and the minimum or night temperature ranging from 40° to 45°. After the fruit is set the temperature should be gradually raised, being kept higher in clear weather than in dull. When the fruit has stoned, the temperature may be raised to 60° or 65° by day and 60° by night; and for ripening off it may be allowed to reach 70° or 80° by sun heat.

The Moorpark is undoubtedly the best apricot in cultivation, and should be planted for all general purposes; the Peach is a very similar variety, not quite identical; and the Hemskerk is also similar, but harder. The Large Early, which ripens in the end of July and beginning of August, and the Kaisa, a sweet-kernelled variety, which ripens in the middle of August, are also to be recommended. For standard trees in favourable localities the Breda and Brussels may be added.

The *Cherry*, *Cerasus avium* and *C. vulgaris*, is increased by budding on the wild gean, obtained by sowing the stones of the small black or red wild cherries. To secure very dwarf trees, the *Cerasus Mahaleb* has been used for the May Duke, Kentish, Morello, and analogous sorts, but it is not adapted for strong-growing varieties like the Bigarreus. The stocks are budded, or, more rarely, grafted, at the usual seasons. The cherry prefers a free, loamy soil, with a well-drained subsoil. Stiff soils and dry gravelly subsoils are both unsuitable, though the trees require a large amount of moisture, particularly the large-leaved sorts, such as the Bigarreus. For standard trees, the Bigarreau section should be planted 30 feet apart, or more in rich soil, and the May Duke, Morello, and similar varieties 20 or 25 feet apart; while, as trained trees against walls and espaliers, from 20 to 24 feet should be allowed for the former, and from 18 to 20 feet for the latter.

In forming the stems of a standard tree, the temporary side-shoots should not be allowed to attain too great a length, and should not

be more than two years old when they are cut close to the stem. The first three shoots retained to form the head should be shortened to about 15 inches, and two shoots from each encouraged, one at the end, and the other 3 or 4 inches lower down. When these have become established, very little pruning will be required, and that chiefly to keep the principal branches as nearly equal in strength as possible for the first few years.

Espalier trees should have the branches about a foot apart, starting from the stem with an upward curve, and then being trained horizontally. In summer pruning the shoots on the upper branches must be shortened at least a week before those on the lower ones. After a year or two clusters of fruit buds will be developed on spurs along the branches, and those spurs will continue productive for an indefinite period.

For wall trees any form of training may be adopted ; but as the fruit is always finest on young spurs, fan-training is probably the most advantageous. A succession of young shoots should be laid in every year. The Morello, which is of twiggy growth, and bears on the young wood, must be trained in the fan form, and care should be taken to avoid the very common error of crowding its branches.

Forcing.—The cherry will not endure a high temperature nor a close atmosphere. A heat of 45° at night will be sufficient at starting, this being gradually increased during the first few weeks to 55°, but lowered again when the blossom buds are about to open. After stoning the temperature may be again gradually raised to 60°, and may go up to 70° by day, or 75° by sun heat, and 60° at night. The best forcing cherries are the May Duke and the Royal Duke, the Duke cherries being of more compact growth than the Bigarreau tribe, and generally setting better ; nevertheless a few of the larger kinds, such as Bigarreau Napoléon, Black Tartarian, and St Margaret's, should be forced for variety. The trees may be either planted out in tolerably rich soil, or grown in large pots of good turfy friable calcareous loam mixed with rotten dung. If the plants are small, they may be put into 12-inch pots in the first instance, and after a year shifted into 15-inch pots early in autumn, and plunged in some loose material as leaves, cocoa-fibre, or ashes. The soil of the pots should be protected from snow-showers and cold rains. Occasionally trees have been taken up in autumn with balls, potted, and forced in the following spring ; but those which have been established a year in the pots are to be preferred. Such only as are well furnished with blossom-buds should be selected. The trees

should be removed to the forcing house in the beginning of December, if fruit be required very early in the season. During the first and second weeks it may be kept nearly close; but, as vegetation advances, air becomes absolutely necessary during the day, and even at night when the weather will permit. If forcing is commenced about the middle or third week of December, the fruit ought to be ripe by about the end of March. After the fruit is gathered, the trees should be duly supplied with water at the root, and the foliage kept well syringed till the wood is mature.

The following are some of the best varieties now in cultivation. B. signifies that they belong to the Bigarreau, D. to the May Duke, and M. to the Morello section; K. indicates that they are specially adapted for culinary purposes; and b., m., and e. show that they are in use at beginning, middle, and end respectively of the month stated:—

Belle d'Orleans, B.	b. m. June.	Archduke, D.	m. July.
Early Purple Gean, B.	m. June.	Royal Duke, D.	m. July.
Early Red Bigarreau, B.	m. e. June.	Joc-o-sot, B.	m. July.
Early Jaboulay, B.	e. June.	Büttner's Yellow, B.	m. July.
Early Lyons, B.	e. June.	Büttner's Black Heart, B.	m. July.
Early Rivers, B.	e. June.	Bigarreau, B.	m. July.
Black Tartarian, B.	{ e. June.	Mammoth, B.	m. e. July.
Bigarreau Noir de	b. July.	Reine Hortense, D.	m. e. July.
Schmidt, B.	} July.	Kentish, M., K.	m. e. July.
Frogmore Early, B.	b. July.	Morello, M., K.	July-Oct.
Elton, B.	b. July.	Bigarreau Napoléon, B.	e. July.
Black Eagle, B.	b. July.	Duchesse de Pallau, D.	e. July.
Governor Wood, B.	b. July.	St Margaret's, B.	{ e. July,
May Duke, D. (on walls) {	e. June.	Florence B.	m. e. Aug.
	b. July.	Büttner's October, D. K. ..	October.

The Cranberry.—The American cranberry, *Oxycoccus macrocarpus*, grows freely in beds of peat soil or bog earth formed for their reception in any damp situation. Beds are often prepared around the edges of a pond by depositing a layer of rubble or stones at the bottom, and over these a good thickness of peat or bog earth mixed with sand, extending about 6 inches below and about 4 inches above the usual level of the water surface. On this bed the cranberry plants should be put in at 2 feet apart, in autumn or spring; spreading in all directions, they will soon cover the whole surface with a dense mat of trailing shoots.

The common cranberry, *Oxycoccus palustris*, a native of Britain, bears fruit which is inferior to that of the American cranberry in

size and quality. The plants may be treated in the same manner, and in some places are very successfully cultivated.

The *Currants* are among the most useful of the small fruits. The red and the white currant are included as varieties under *Ribes rubrum*, the white being a pale-fruited variety of the red. The black currant is the produce of *Ribes nigrum*. Of both types there are several greatly improved varieties.

Red and white currants are readily propagated by cuttings. They



FIG. 164.—Standard Currant.

succeed in any well-enriched garden soil, but thrive best in warm moist situations, where they enjoy an abundance of air; occasionally they are trained perpendicularly against low walls or fences. As bushes they are best planted in compartments by themselves, at about 5 or 6 feet apart each way, and should be on clean single stems some 8 or 10 inches long. They are sometimes trained as standards (fig. 164) on single stems, 3 or 4 feet high, in which form the fruit is

more accessible. The winter pruning consists in shortening the young bearing wood on the sides of the branches so as to form spurs of an inch or two in length. The leading shoots are left about 6 inches long. Some cultivators reduce the young shoots to about half their length as soon as the fruit begins to colour, which is found to increase the size and improve the flavour of the berries.

The black currant thrives best in a moist deep soil and shady situation. Its culture is much the same as that of the other currants, but the young shoots are not spurred, all the pruning necessary being to keep the branches thinned out so as to stand clear of each other, and to promote the formation of young wood. If the fruit is intended for preserving, it should not be gathered while wet, nor, if it can be avoided, immediately after a wet period.

Aphides often cluster in vast numbers at the extremities of the summer shoots, especially of red and white currants, and should be destroyed by cutting off and burning the parts infested, or by applying some of the many insecticides.

The following are the best sorts of currants for general purposes:—

Red.—Red Dutch, Knight's Large Red, Houghton Seedling or Orangefield (late), Gondouin or Baby Castle (late), Lace-leaved or Large Sweet Red, Champagne (flesh-coloured).

White.—White Dutch, Wilmot's Large White.

Black.—Black Naples, Black Grape or Ogden's, Lee's Prolific.

The *Fig*, *Ficus Carica*, lives to a great age, and along the southern coast of England bears fruit abundantly as a standard; but in Scotland and in many parts of England a south wall is indispensable for its successful cultivation out of doors.

Fig trees are propagated by cuttings, which should be put into pots, and placed in a gentle hotbed. They may be obtained more speedily from layers, which should consist of two or three years old shoots, and these, when rooted, will form plants ready to bear fruit the first or second year after planting. The best soil for a fig border is a friable loam, not too rich, but well drained; a chalky subsoil is congenial to the tree, and, to correct the tendency to over-luxuriance of growth, the roots should be confined within spaces surrounded by a wall enclosing an area of about a square yard. The sandy soil of Argenteuil, near Paris, suits the fig remarkably well; but the best trees are those which grow in old quarries, where their roots are free from stagnant water, and where they are sheltered from cold, while exposed to a very hot sun, which ripens

the fruit perfectly. The fig succeeds well planted in a paved court against a building with a south aspect.

The fig tree naturally produces two sets of shoots and two crops of fruit in the season. The first shoots generally show young figs in July and August, but these in the climate of England very seldom ripen, and should therefore be rubbed off. The late or midsummer shoots likewise put forth fruit-buds, which, however, do not develop themselves till the following spring; and these form the only crop of figs on which the British gardener can depend.

The fig tree grown as a standard should get very little pruning, the effect of cutting being to stimulate the buds to push shoots too vigorous for bearing. When grown against a wall, it has been recommended that a single stem should be trained to the height of a foot. Above this a shoot should be trained to the right, and another to the left; from these principals two secondary branches should be encouraged, and trained 15 inches apart; and along these branches, at distances of about 8 inches, shoots for bearing, as nearly as possible of equal vigour, should be encouraged. The bearing shoots produced along these leading branches should be trained in at full length, and in autumn every alternate one should be cut back to one eye. In the following summer the trained shoots should bear and ripen fruit, and then be cut back in autumn to one eye, while shoots from the bases of those cut back the previous autumn should be trained for succession. In this way every leading branch will be furnished alternately with bearing and successional shoots.

When protection is necessary, as it may be in severe winters, though it is too often provided in excess, spruce branches have been found to answer the purpose exceedingly well, owing to the fact that their leaves drop off gradually when the weather becomes milder in spring, and when the trees require less protection and more light and air. One very vital part requiring protection is the main stem, which is perhaps more tender than the young wood.

Forcing.—The fig requires more heat than the vine to bring it into leaf. It may be subjected to a temperature of 50° at night, and from 60° to 65° in the day, and this should afterwards be increased to 60° and 65° by night, and 70° to 75° by day, or even higher by sun heat, giving plenty of air at the same time. In this temperature the evaporation from the leaves is very great, and this must be replaced and the wants of the swelling fruit supplied by daily watering, by syringing the foliage, and by moistening the floor, this atmospheric moisture being also necessary to keep down

the red spider. When the crop begins to ripen, a moderately dry atmosphere should be maintained, with abundant ventilation when the weather permits.

The fig tree is easily cultivated in pots, and by introducing the plants into heat in succession the fruiting season may be considerably extended. The plants should be potted in turfy loam mixed with charcoal and old mortar rubbish, and in summer top-dressings of rotten manure, with manure water two or three times a week, will be beneficial. While the fruit is swelling, the pots should be plunged in a bed of fermenting leaves.

The following are a few of the best figs ; those marked F. are good forcing sorts, and those marked W. suitable for walls :—

Agen : brownish-green, turbinate.
 Angélique (Madeleine), F., W. : yellow, turbinate.
 Brown Ischia, F. : chestnut-coloured, roundish-turbinate.
 Brown Turkey (Lee's Perpetual), F., W. : purplish-brown, turbinate.
 Brunswick, W. : brownish-green, pyriform.
 Col di Signora Blanca, F. : greenish-yellow, pyriform.
 Col di Signora Nero : dark chocolate, pyriform.
 Datte : pale dingy brown, pyriform.
 Early Violet, F. : brownish-purple, roundish.
 Grizzly Bourjassotte : chocolate, round.
 Grosse Monstrueuse de Lipari : pale chestnut, turbinate.
 Lucrezia : dull white, roundish.
 Negro Largo, F. : black, long pyriform.
 Royal Vineyard : purple, long pyriform.
 White Ischia, F. : greenish-yellow, roundish-obovate.
 White Marseilles, F., W. : pale green, roundish-obovate.

The *Gooseberry* has a double parentage, *Ribes Grossularia* being the parent of the rough or hairy-fruited sorts, and *R. Uva-crispa* that of the smooth-fruited ones. It prefers a loose holding soil, which readily imbibes, but does not retain, much moisture. The plant is propagated by cuttings, and should be transplanted early in autumn, the trees, like those of the currant, being ranged in lines or grouped in compartments. The trees should be formed with single stems a foot high ; and the suckers, if any spring up from the roots, should be carefully removed. Formerly it was the practice in Scotland to spur all the annual wood ; but now the black currant system of pruning is more generally and advantageously followed. The ground on which the bushes stand should be forked over once a year, but only slightly, so as not to disturb the roots, and manure should be applied either as a top-dressing or in a liquid form. The caterpillars which attack the plant may be destroyed by dusting

the leaves with powdered white hellebore, which seems to be the only certain remedy, as even hand-picking fails in some seasons when the caterpillars are very abundant, and the trees are numerous.

The gooseberry, like the currant, may be grown as a standard



FIG. 165.—Standard Gooseberry.

(fig. 165); it may be also, like the currant, trained on walls or espaliers, to accelerate the ripening or increase the size of the fruit.

The following is a good limited selection of sorts :—

Hairy Reds.—Red Champagne, Red Warrington, Keens' Seedling, Rough Red, Lord Derby, Henson's Seedling, Crown Bob, Companion.

Hairy Yellows.—Yellow Champagne, Early Sulphur (very early), Catharina, Fanny, Broom Girl.

Hairy Greens.—Early Green Hairy, Glenton Green, Thunder.

Hairy Whites.—White Champagne, Bright Venus, White Lion, Transparent, Snowdrop, Fascination, Antagonist.

Downy Whites.—Whitesmith, Cheshire Lass, Maid of the Mill, Early White.

Smooth Reds.—London (large), Plough Boy, Small Red Globe, Turkey Red.

Smooth Yellows.—Smiling Beauty, Leveller, Gipsy Queen, Leader, Ringer.

Smooth Greens.—Pitmaston Green-gage, Telegraph, Heart of Oak, Green Overall, Shiner, General Markham.

Smooth Whites.—White Honey, White Fig, Careless, Freedom.

The *Medlar*, *Mespilus germanica*, is a deciduous tree, native of the middle and south of Europe, and found in hedges and woods in England. Its fruit is hard, acid, and unfit for eating till it loses its green colour and becomes "bletted," in which state it acquires an agreeably acid and somewhat astringent flavour.

The medlar is propagated by budding or grafting upon the white-thorn, which is most suitable if the soil is dry and sandy, or on the quince if the soil is moist. It produces the best fruit in rich, loamy, somewhat moist ground. The tree may be grown as a standard, and chiefly requires pruning to prevent the branches from crossing and rubbing each other. The fruit should be gathered in November, on a dry day, and laid out upon shelves in the fruit room. It becomes bletted and fit for use in the course of two or three weeks.

The *Melon*, *Cucumis Melo*, is an annual tropical plant of climbing or trailing habit, extensively cultivated in Persia and some parts of India. The plant requires artificial heat to grow it to perfection, the rock and cantaloup varieties succeeding with a bottom heat of 70° and an atmospheric temperature of 75°, rising with sun heat to 80°, and the Persian varieties requiring a bottom heat of 75°, gradually increasing to 80°, and an atmospheric temperature ranging from 75° to 80° when the fruit is swelling, as much sun heat as the plants can bear being allowed at all times. The melon grows best in rich turfy loam, somewhat heavy, with which a little well-rotted dung, especially that of pigeons or fowls, should be used, in the proportion of one-fifth mixed in the compost of loam.

Melons are grown on hotbeds of fermenting manure, when the soil should be about a foot in thickness, or in pits heated either by hot water or fermenting matter, or in houses heated by hot water, in which case the soil bed should be 15 or 18 inches thick. The fermenting materials should be well prepared, and, when the heat has to be kept up by linings, it is a good plan to introduce one or two layers of faggots in building up the bed. A mixture of dung and leaves gives a more subdued but more durable heat.

For all ordinary purposes February is early enough for sowing the first crop, as well-flavoured fruits can scarcely be looked for before May. The seeds may be sown singly in 3-inch pots in a mixture of leaf-mould with a little loam, the pots being plunged in a bottom heat of 75° to 80°, and as near the glass as possible, in order that the young plants may not be drawn up. The hill or ridge of soil should be a foot or more in thickness, and must have become thoroughly warmed before the young seedlings are planted in it. If the fruiting bed is not ready when their roots have nearly filled the pots, they must be shifted into 4-inch pots, for on no account must they be allowed to get starved or pot-bound. Two or three plants are usually planted in this mound or ridge of soil, which is placed in the centre of each light, and the rest of the surface is covered over to a similar depth as soon as the roots have made their way through the mound.

The mode of pruning and training is similar whether the plants are grown on a trellis or on the surface of a bed, with this difference that in the former case the main stem has to be carried up to a sufficient height to reach the trellis before it is stopped. When the plants are trained on the surface of the beds the tops should be pinched off as soon as the second rough leaf is fairly formed, the stopping being effected either long enough before planting to allow the buds to break, or not until the plants have taken fresh root after planting. One branch will thus be developed from the axil of each of the two leaves, and they should be trained one towards the front and the other towards the back of the frame, before reaching which the points should be pinched off and lateral fruit-bearing shoots will then be produced.

The melon being one of those plants which produce distinct male and female flowers (monœcious), it is necessary to its fertility that both should be produced, and that the pollen of the male flower should, either naturally by insect agency, or artificially by the cultivator's manipulation, be conveyed to the stigma of the female flower; this "setting" of the fruit is often done by stripping a male flower of its corolla, and inverting it in the centre of the fruit-bearing flower. After the fruit has set and has grown to the size of an egg, it should be preserved from contact with the soil by placing it on a piece of tile or slate; or if grown on a trellis by a little swinging wooden shelf, just large enough to hold it. In either case the material used should be tilted a little to one side, so as to prevent water lodging on it. Before the process of ripening commences, the roots should have a

sufficient supply of moisture, so that none may be required from that time until the fruit is cut.

When the melon is grown in a house there should be a good depth of drainage over the tank or other source of bottom heat, and on this should be placed turfs, grass side downwards, below the soil, which should not be less than 12 and need not be more than 15 inches in thickness. The compost should be made moderately firm, and only half the bed should be made up at first, the rest being added as the roots require it. The melon may also be grown in large pots, supplied with artificial manure or manure water. The stems may be trained up a trellis in the usual way, or the rafters of a pine stove may be utilized for the purpose. If the trellis is constructed in panels about the width of the lights, it can be taken down and conveniently stowed away when not in use.

The presence of too much moisture either in the atmosphere or in the soil is apt to cause the plants to damp off at the neck, but the evil, if it appears, may be checked by applying a little fresh-slaked lime round the stem of the plant.

The varieties of melon are continually receiving additions which are more or less permanent. A great deal depends on getting the varieties true to name, as they are very liable to get cross-fertilized by insect agency. Some of the best are—

Scarlet-fleshed.—Blenheim Orange, Scarlet Gem, and Read's Scarlet-fleshed.

White-fleshed.—Hero of Lockinge, Colston Basset Seedling, and Queen Emma.

Green-fleshed.—Victory of Bath, Eastnor Castle, and Bellamore Hybrid.

The *Mulberry*, *Morus nigra*, is a deciduous tree, with monœcious flowers, and oblong compound fruits, having a rich aromatic flavour and a fine subacid juice. The fruit is in request for the dessert during the months of August and September. It is a native of Persia, and succeeds well as a standard in the warmer parts of England, especially in sheltered situations, but in the north of England and the less favoured parts of Scotland it requires the assistance of a wall. The standard trees require no other pruning or training than an occasional thinning out of the branches, and are generally planted on grassy lawns, to prevent damage to the fruit.

The tree succeeds best in a rich, deep, and somewhat moist loam, but grows well in any good free garden ground. It is propagated either by cuttings or layers, which latter, if made from the older branches of the tree, come sooner into bearing. Cuttings planted in the spring should consist of well-ripened shoots of the preceding

year, with a joint of two-year-old wood at their base, or if planted in autumn should have the shoots well matured, and furnished with a heel of two-year-old wood. The branches and even stout



FIG. 166.—Bush Nectarine; Elrnge, 3 years old.

limbs are sometimes employed as cuttings instead of the younger shoots, especially when the object is to obtain a bearing tree quickly. The branch should be planted deeply in autumn in good soil, and if necessary supported in an upright position by a stake. The most

common mode of propagation, however, is by layering the young branches. The mulberry may be grown in pots, and gently forwarded in an orchard house, and under these conditions the fruit acquires a richness of flavour and a melting character which is unknown in the fruit ripened outdoors. If cultivated in this way it requires abundance of water while the fruit is swelling, and also frequent dressings of artificial fertilizers or doses of liquid manure.

The *Nectarine* (fig. 166) is merely a smooth-skinned variety of the peach, and will be included under that head : which see.

The *Nut*, *Corylus Avellana*, or hazel-nut, one of our indigenous shrubs, is the parent of the Filberts, Cob Nuts, and other improved varieties which are met with under cultivation. These succeed best in a rich dry loam, deeply worked, and should receive from time to time a slight manuring. They are generally planted in the slip, but thrive best in an open quarter by themselves. The different varieties are propagated by layers, or more generally by suckers; or, if required, they may be grafted. The Cosford is a favourite kind, being a thin-shelled nut, and having a kernel of high flavour. If either this or the filbert be grafted on small stocks of the Spanish nut, which grows fast, and does not send out suckers, dwarfish prolific trees may be obtained; and, by pruning the roots in autumn, the trees may be kept quite neat and bushy.

The county of Kent has long been celebrated for the culture of nuts for the London market. The young plants are almost always suckers from old bushes, and are planted from 10 to 12 feet apart, being subsequently kept from crowding or shading each other by pruning. They are suffered to grow without restraint for about three years, and then, being cut down to within 12 or 18 inches of the ground, they will push out from near the top five or six shoots, which at the winter pruning in their second year are shortened one-third. A hoop of sufficient diameter is then placed within the branches, and the shoots are fastened to it at about equal distances. In the spring of the fourth year all the laterals are cut back nearly to the principal stems, and from these cut-back laterals short shoots proceed, on which fruit may be expected in the following year. Those which have borne fruit are afterwards removed by the knife. The leading shoots are always shortened about two-thirds. Every bearing twig is deprived of its top, and all suckers are carefully rooted out.

The nut being a monœcious plant, it is necessary in the winter or spring pruning to take care that a sufficiency of the male flowers—those produced in pendulous catkins—are preserved. The female flowers, which produce the fruit, are not visible till spring, and appear in the form of plump buds, producing from their apex several deep crimson threads, which are the styles to which the pollen from the catkins should be applied.

The best kinds of nuts for garden cultivation are Lambert's Filbert, the Red and the White Filberts, the Cosford, the Norwich Prolific, and Pearson's Prolific.

The *Orange*, *Citrus Aurantium*, has been usually cultivated in England for the beauty of the plant and the fragrance of its blossoms, rather than for the purpose of affording a supply of edible fruit. The latter can, however, be easily grown in a hot-house, some of the fruits thus grown, especially those of the pretty little Tangierine variety, being superior in quality to the imported fruit. The best form of orange house is the span-roofed, with glass on both sides, the height and other conditions being similar to those recommended for stove plants. The trees may be planted out, a row on each side a central path, in a house of moderate width. The borders must be carefully made, with a drainage bottom of from 9 to 12 inches of broken bricks or rubbly stones, and a drain leading to the exterior. Rough turf with the grassy side downwards should be laid over the drainage material, and then 18 inches of good turfy loam mixed with gritty sand or fine burnt ballast, to keep it permeable to water. The trees, if intended to be permanent, should be placed 10 to 12 feet apart. Bottom heat (about 80°) is beneficial; but it is questionable if its advantages beneath a bed of soil are not more than counterbalanced by the risk of over-dryness, and the inconvenience of getting access to the heating pipes in case of repairs becoming necessary. It will generally be found more convenient to grow the plants in pots or tubs, and then bottom heat can be secured by placing them on or over a series of hot-water pipes kept near to or above the ground level. The pots or tubs should be thoroughly well drained. The temperature may be kept at about 50° or 55° in winter, under which treatment the trees will come into bloom in February; the heat must then be increased to 60° or 65° in the day time, and later on to 80° or 85°. Throughout the growing season the trees should be liberally watered, and thoroughly washed every day with the garden engine, care being taken not to injure the young leaves; this will materially assist in keeping down insects.

The fruit may be expected to ripen from about the middle of October to January, and if the sorts are good will be of excellent quality. When the trees are at rest the soil must not be kept too wet, since this will produce a sickly condition, through the loss of the small feeding roots. The trees require little pruning or training. When a branch appears to be robbing the rest, or growing ahead of them, it should be shortened back or tied down.

When grown for the production of flowers, which are always in great request, the plants must be treated in a similar manner to that already described, but may do without bottom heat.

The favourite sorts of oranges are the Tangierine, a delicious small-fruited early variety; the Mandarin, which is larger than Tangierine; the St Michael's, which is the most commonly grown; the Maltese Blood, which is a very distinct sort with red flesh; and the Plata or silver orange.

The *Peach*, *Amygdalus Persica*, or *Persica vulgaris*, is one of the most delicious of exotic garden fruits. There are two principal races, the *Peach* proper, which has fruits covered with a downy skin, and the *Nectarine*, which has fruits covered with a smooth skin. The peach and the nectarine would therefore appear to be distinct kinds of fruit, and indeed have an appreciable difference of flavour; but as both peaches and nectarines have been known to grow on the same branch, and individuals half-peach half-nectarine have been produced, they must be regarded as merely varieties of one kind of fruit. Their treatment, moreover, is the same in every respect. As pot plants in the orchard-house they are very productive. In these structures they are grown as bushes (fig. 166), as pyramids (fig. 176), or as half standards (fig. 167).

To perpetuate and multiply the choicer varieties, peaches and nectarines are budded upon plum or almond stocks. For dry situations almond stocks are preferable, but they are not long-lived, while for damp or clayey loams it is better to use plums. Double-working is sometimes beneficial; thus an almond budded on a plum stock may be rebudded with a tender peach, greatly to the advantage of the latter. The peach border should be composed of turfy mellow loam, such as is suitable for the vine and the fig; this should be used in as rough a state as possible, or not broken small and fine. The bottom should slope towards the outer edge, where a drain should be cut, with an outlet, and on this sloping bottom should be laid a thickness of from 9 inches to 12 inches of rough materials, such as broken bricks or mortar rubbish, over which should be placed a layer of rough turf with the grassy side down-

wards, and then the good loamy soil to form the border, which need not be of greater depth than 18 inches, for the peach tree is most productive when the roots are kept near the surface. The borders should not be cropped heavily with culinary vegetables, as deep trenching is very injurious. Sickly and unfruitful trees may often be revived by bringing up their roots within 5 or 6 inches of the surface. The experience of the last few seasons has, however, been so disastrous that it has been questioned whether it may not



FIG. 167.—Half-standard Peach; Alexander.

be better, in cold soils and bleak situations, to abandon outdoor peach culture, and to cover the walls with a casing of glass, so that the trees may be under shelter during the uncongenial spring weather.

The fruit of the peach is produced on the ripened shoots of the preceding year. If these be too luxuriant, they yield nothing but leaves; and if too weak, they are incapable of developing flower buds. To furnish young shoots in sufficient abundance, and of

requisite strength, is the great object of peach training and pruning. Trees of slender-growing, twiggy habit naturally fall most readily into the fan form of training, and accordingly this has generally been adopted in the culture of peaches and nectarines. The old fan form is very nearly that of fig. 82 (p. 168). The young tree is, in many cases, procured when it has been trained for two or three years in the nursery; but it is generally better to commence with a maiden plant, that is, a plant of the first year after it has been budded. It is then in ordinary practice headed down to five or six buds, and in the following summer from two to four shoots, according to the vigour of the plant, are trained in, the laterals from which, if any, are thinned out and nailed to the wall. If there are four branches, the two central ones are shortened back at the subsequent winter pruning so as to produce others, the two lower ones being laid in nearly at full length. In the following season additional shoots are sent forth; and the process is repeated till eight or ten principal limbs or mother branches are obtained, forming, as it were, the frame-work of the future tree. The branches may be depressed or elevated, so as to check or encourage them, as occasion may arise; and it is highly advantageous to keep them thin, without their becoming in any part deficient of young shoots. Sometimes a more rapid mode of formation is now adopted, the main shoots being from the first laid in nearly at full length, instead of being shortened. The pruning for fruit consists in shortening back the laterals which had been nailed in at the disbudding, or summer pruning, their length depending on their individual vigour and the luxuriance of the tree. In well-developed shoots the buds are generally double, or rather triple, a wood bud growing between two fruit buds; the shoot must be cut back to one of these, or else to a wood bud alone, so that a young shoot may be produced to draw up the sap beyond the fruit, which is generally desirable to secure its proper swelling. The point of this leading shoot is later on pinched off, that it may not draw away too much of the sap. If the fruit sets too abundantly, it must be thinned, first when as large as peas, reducing the clusters, and then when as large as nuts to distribute the crop equally; the extent of the thinning must depend on the vigour of the tree, but one or two fruits ultimately left to each square foot of wall is a full average crop. The final thinning should take place after stoning.

The best-placed healthy young shoot produced from the wood buds at the base of the bearing branch, is to be carefully preserved, and in due time nailed to the wall. In the following winter this will

take the place of the branch which has just borne, and is to be cut out. If there be no young shoot below, and the bearing branch is short, the shoot at the point of the latter may sometimes be preserved as a fruit bearer, though if the bearing branch be long it is better to cut it back for young wood. It is the neglect of this which constitutes the principal fault in carrying out the English fan system, as it is usually practised. Several times during sum-

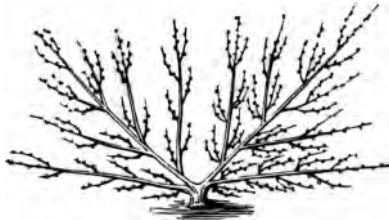


FIG. 168.—Montreuil Fan Training.

mer the trees ought to be regularly examined, and the young shoots respectively topped or thinned out; those that remain are to be nailed to the wall, or braced in with pieces of slender twigs, and the trees ought occasionally to be washed with the garden engine.

The Montreuil form of training is represented by fig. 168. The principal feature is the suppression of the direct channel of the sap, and the substitution of four, or more commonly two, mother branches,

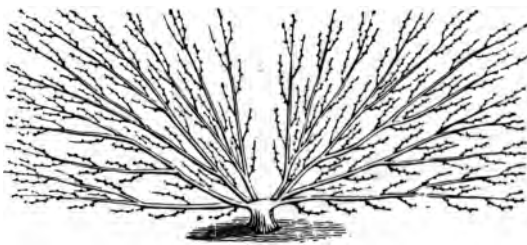


FIG. 169.—Dumoutier's Fan Training.

so laid to the wall that the central angle contains about 90° . The other branches are all treated as subordinate members. This form is open to the objection that, if the under branch should die the upper one cannot be brought down into its place.

The form à la Dumoutier (fig. 169), so called from its inventor, is merely a refinement on the Montreuil method. The formation of

the tree commences with the inferior limbs and proceeds towards the centre, the branches being lowered from time to time as the tree acquires strength. What is most worthy of notice in this method is the management of the subordinates in the pruning for fruit. When a shoot promises blossom, it is generally at some distance from the point of insertion into the old wood, and the intermediate space is covered with wood buds. All the latter, therefore, which are between the old wood *a* and the blossom *c*, fig. 170, except the lowest *b*, are carefully removed by *ebourgeonnement*. This

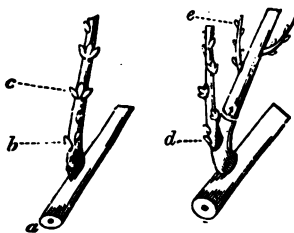


FIG. 170.—Pruning à la Dumoutier.

never fails to produce a shoot *d*, the growth of which is favoured by destroying the useless spray *e* above the blossoms, and pinching off the points of those which are necessary to perfect the fruit. A replacing shoot is thus obtained, to which the whole is invariably shortened at the end of the year.

Mr Seymour's form (fig. 171) approaches more nearly to the French method than any other practised in England, but the direct channel of the sap is not suppressed. It will be seen that the bearing shoots

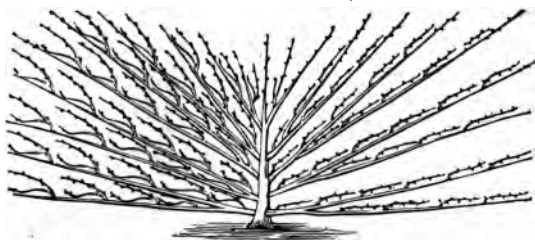


FIG. 171.—Seymour's Fan Training.

are all on the upper side of the mother branches, and that these bearing shoots are wholly reproduced once a year. The one side of the annexed figure represents the tree after the winter pruning, the other (left hand) side before it has undergone that operation. On the latter side the young shoots will be seen to be in pairs, and at the winter pruning the lower one, or that which has borne fruit, is cut out, and the other is brought down into its place, and shortened

to about 8 or 9 inches, care being taken to cut at a wood bud. At the summer disbudding those buds which are best placed and at the same time nearest the base are left to supply the future year's bearing wood. Some object that the annual excision of the bearing shoots produces a series of rugged and increasingly ugly protuberances at their base and along the upper surface of the principal branches; while others declare that this mode of training is the most perfect in theory that has been devised. We are inclined, however, to prefer the old fan form, which when well executed is nearest the natural habit of the tree, and best adapted to the uncertain climate of England. Moreover, in any case, ultra refinement for the sake of appearance is neither profitable nor judicious.

For cold and late situations, the late Thomas Andrew Knight recommended the encouragement of spurs on the young wood, as such spurs, when close to the wall, generate the best organized and most vigorous blossoms, and generally insure a crop of fruit. They may be produced, by taking care, during the summer pruning or disbudding, to preserve a number of the little shoots emitted by the yearly wood, only pinching off the minute succulent points. On the spurs thus formed blossom buds will be developed early in the following season. This practice is said to be well adapted to cold situations.

Peach trees require protection, especially at the period of blossoming, particularly in the colder parts of England and in Scotland. Canvas or bunting screens are most effectual. By applying these early in the season, great benefit may be derived from retarding the blossom till the frosty nights of spring have passed. Wooden and glass copings are also very useful in warding off frosts.

Forcing.—The pruning and training of the trees in the peach house do not differ materially from the methods practised out of doors. It may also be stated here that when occasion arises peach trees well furnished with buds may be transplanted and forced immediately without risking the crop of fruit, a matter of some importance when, as sometimes happens, a tree may accidentally fail. In the forcing of peaches fire heat is commonly applied about the middle of January; but it may, where there is a demand, begin a month or so sooner. At first the house should be merely kept closed at about 45°, but the heat at night should increase to 55° by the time the trees are in flower, and to 60° when the fruit is set; after this the house should be kept moist by sprinkling the walls and paths, or by placing water troughs on the return pipes, and the tem-

perature should range from 65° to 70° by day, but lower during the night. After the fruit has set, the foliage should be refreshed and cleansed by the daily use of the syringe or garden engine. When the fruit has stoned, that is, as soon as the kernels have been formed, the temperature should be raised to about 65° as a minimum, and by day to 70°, with 80° by sun heat, as a maximum. Water must now be copiously supplied to the border, and air admitted in abundance. After the end of April more sun heat may be utilized. When the fruit begins to ripen, syringing must be discontinued till the crop is gathered, after which the syringe must be again occasionally used. If the leaves should happen to shade the fruit, not only during the ripening process, but at any time after the stoning period, they should be gently turned aside, for, in order that the fruit may acquire good colour and flavour, it should be freely exposed to light and air when ripening; it will bear the direct rays of the sun, even if they should rise to 100°. The trees often suffer from mildew, which is best prevented by keeping the borders of the peach house clear and sufficiently moist, and the house well ventilated.

The following are some of the best sorts of peaches and nectarines, old and new, arranged in the order of the usual period of their ripening:—

Peaches.

Early Beatrice.....	e. July.	Premier.....	{ e. Aug. b. Sept.
Early Louise.....	e. July.	Royal George.....	{ e. Aug. b. Sept.
Frogmore Golden.....	e. July.	Bellegarde.....	b.m. Sept.
Hale's Early.....	b. Aug.	Belle Bauce.....	m. Sept.
Rivers's Early York.....	b.m. Aug.	Dymond.....	m. Sept.
A Bec.....	m. Aug.	Late Admirable.....	m.e. Sept.
Washington Rathripe.....	m. Aug.	Dease Tardive.....	{ e. Sept. b. Oct.
Early Silver.....	{ e. Aug. m.e. Aug.	Walburton Admirable ..	{ e. Sept. b. Oct.
Crawford's Early.....	{ e. Aug. b. Sept.	Salway.....	{ e. Oct. b. Nov.
Grosse Mignonne.....	{ e. Aug. b. Sept.		
Noblesse.....	{ e. Aug. b. Sept.		

Nectarines.

Lord Napier.....	b. Aug.	Violette Hâtive.....	{ e. Aug. b. Sept.
Rivers's White.....	m. Aug.	Welbeck Seedling.....	{ e. Aug. b. Sept.
Murrey.....	e. Aug.	Victoria (under glass)....	Sept.
Balgowan.....	{ e. Aug. b. Sept.	Pine-apple.....	b. Sept.
Elruge.....	{ e. Aug. b. Sept.	Stanwick Elruge.....	b. Sept.
Pitmaston Orange.....	{ e. Aug. b. Sept.	Albert Victor.....	m.e. Sept.
		Stanwick (under glass)....	m.e. Sept.

The *Pear* has originated in part from the wild species, *Pyrus communis*, and in part from other species of the genus, including *P. sinensis* from China, *P. Achras* from Southern Russia, *P. Sinai* from Syria, and *P. salicifolia* from the Caucasus. It may be readily raised by sowing the pips of ordinary cultivated or of wilding kinds, these forming what are known as free or pear stocks, on which the choicer varieties are grafted for increase. For new varieties the flowers should be fertilized with a view to combine, in the



FIG. 172.—Pyramid Pear ;
Louise Bonne.



FIG. 173.—Bush Pear; Beurré
d'Amanlis, 3½ feet high.

seedlings which result from the union, the desirable qualities of the parents. The pyramid trees (fig. 172), and also the dwarf bush trees (figs. 173, 174), more usually planted in gardens, are obtained by grafting on the quince stock, the Portugal quince being the best ; but this stock, from its surface-rooting habit, is most suitable for thin shallow soils, or for those of a cold damp nature.

Some of the finer pears do not unite readily with the quince, and in this case double working is resorted to; that is to say, a vigorous-growing pear is first grafted on the quince, and then the choicer pear is grafted on the pear introduced as its foster parent.

In selecting young pear trees for walls or espaliers, some persons prefer plants one year old from the graft, but trees two or three years trained are equally good. The trees should be planted immediately before or after the fall of the leaf. The wall trees require to be planted from 25 to 30 feet apart when on free stocks, and from 15 to 20 feet when dwarfed. Where the trees are trained *en pyramide*, or *en quenouille* (see figs. 78, 79), they may stand 8 or 10 feet apart, but standards in orchards should be allowed at least 30 feet, and dwarf bush trees half that distance.

In the formation of the trees the same plan may be adopted as has already been described as suitable for the apple. For the pear orchard a warm situation is very desirable, with a soil deep, substantial, and thoroughly drained. Any good free loam is suitable, but a calcareous loam is the best. The late Mr Rivers recommends that pear trees worked on the quince should have the stock covered up to its junction with the graft. This is effected by raising up a small mound of rich compost around it, a contrivance which induces the graft to emit roots into the surface soil, and also keeps the stock from becoming hard or bark-bound. The fruit of the pear is produced on spurs, which appear on shoots more than one year old. The mode most commonly adopted of training wall pear-trees is the horizontal (see figs. 80, 81). For the slender twiggy sorts the fan form is to be preferred, while for strong growers like Gansel's Bergamot, the half-fan or the horizontal is more suitable. In the latter form old trees are apt to acquire an undue projection from the wall, and become scraggy, to avoid which a portion of the old spurs should be cut out annually.

The summer pruning of established wall or espalier-rail trees consists chiefly in the timely displacing or rubbing off of the superfluous shoots, so that the winter pruning, in horizontal training, is little more than adjusting the leading shoots and thinning out the spurs, which should be kept close to the wall, and allowed to retain but two or at most three buds. In fan-training, the subordinate branches must be regulated, the spurs thinned out, and the young laterals finally established in their places. When horizontal trees have fallen into disorder, the branches may be cut back to within 9 inches of the vertical stem and branch, and trained in

afresh, or they may be grafted with other sorts, if a variety of kinds is wanted.

Summer and autumn pears should be gathered before they are fully ripe, otherwise they will not in general keep more than a few days. The Jargonelle, as Forsyth rightly advises, should be allowed to remain on the tree, and be pulled daily as wanted, the fruit from



FIG. 174.—Bush Pear on Quince; 22 years old,
5 feet high.

standard trees thus succeeding the produce of the wall trees. In reference to the Crassane, Mr G. Lindley recommends gathering the crop at three different times, the first a fortnight or more before it is ripe, the second a week or ten days after that, and the third when fully ripe. The first gathering will come into eating latest, and thus the season of the fruit may be considerably prolonged. It is evident that the same method may be followed with other sorts which continue only a short time in a mature state.

The varieties of pears are very numerous, while comparatively few sorts are required in any ordinary garden. The following is a small selection of good sorts which do well in the climate of Britain,

and they are arranged according to the months when they are commonly in use,—a period which, however, varies considerably in different seasons:—

Dessert Pears.

Doyenné d'Été.....	July.	Maréchal de Cour.....	Oct., Nov.
Beurré de l'Assomption...	Aug.	Pitmaston Duchesse } d'Angoulême }	Oct., Nov.
Jargonelle.....	Aug.	Althorp Crasane.....	Oct.—Dec.
Souvenir du Congrès.....	Aug., Sept.	Thompson's.....	Nov.
Williams's Bon Chrétien...	Aug., Sept.	Huyshe's Prince Consort..	Nov., Dec.
Beurré d'Amanlis.....	Sept.	Passe Colmar.....	Nov., Dec.
Madame Treyve.....	Sept.	Winter Nella.....	Nov.—Feb.
Beurré Superfin.....	Sept., Oct.	Chaumontel.....	Nov.—Mar.
Fondante d'Automne.....	Sept., Oct.	Beurré d'Arenberg.....	Dec., Jan.
Baronne de Mello.....	Oct.	Glou Morceau.....	Dec., Jan.
Comte de Lamy.....	Oct.	Huyshe's Victoria.....	Dec., Jan.
Louise Bonne of Jersey...	Oct.	Monarch.....	Dec., Jan.
Seckel.....	Oct.	Zéphirin Grégoire.....	Dec., Jan.
Belle Julie.....	Oct., Nov.	Beurré de Jonghe.....	Dec.—Feb.
Beurré Bosc.....	Oct., Nov.	Joséphine de Malines.....	Jan., Feb.
Doyenné du Comice.....	Oct., Nov.	Easter Beurré.....	Jan.—Apr.
Duchesse d'Angoulême...	Oct., Nov.	Nec plus Meuris.....	Jan.—Apr.
Gansel's Bergamot.....	Oct., Nov.	Nouvelle Fulvie.....	Feb., Mar.
Marie Louise.....	Oct., Nov.		

Kitchen Pears.

Beal d'Héry.....	Oct.—Jan.	Bellissime d'Hiver.....	Nov.—Apr.
Black Worcester.....	Nov.—Feb.	Catillac.....	Dec.—Apr.
Flemish Bon Chrétien....	Nov.—Mar.	Winter Franc Réal.....	Jan.—Mar.
Verulam.....	Nov.—Mar.	Uvedale's Saint Germain..	Jan.—Apr.

The *Pine-apple*, *Bromelia Ananas*, or *Ananassa sativa*, requires for its cultivation a tropical climate similar to that of the West Indies—a mean temperature of 70° at the coldest and of 83° at the warmest season, with a range of about 10° between the night and day temperature. It also requires a supply of heat, averaging about 90°, to the soil in which the roots are placed, and hence it is grown in a hot-house, where it can be supplied with bottom heat, by being plunged in a bed of fermenting material, such as tanner's bark or decaying leaves, or by hot water applied either in pipes passing through hollow chambers, or shallow hot-water tanks placed beneath the plunging beds. The heat arising from violent fermentation is, however, greater than the tender roots can bear, and if great watchfulness be not employed, the labour of many months may be wasted in a day. The bottom heat should not exceed 95°, and may be brought down when active growth is not required to about 75°

It must be regulated in its application by the amount of light and of warmth in the air. During the season when the plants are at rest it should be comparatively low; during their season of active growth it should be considerable; and during their ripening season it should be highest of all.

The top spit of an old loamy pasture, including the turf, and mixed with about one-third its bulk of good well-rotted dung, forms a suitable compost for the pine-apple. The soil used at Meudon, where these fruits have been very successfully grown, is a sandy peat or leaf-mould obtained from a high-lying spot, where hardwooded trees, chiefly beech, have long been growing. The late Mr Fleming, when at Trentham, used a mixture of three parts turfy maiden loam to one part of peat, these ingredients being mixed together and laid under a wooden platform on which sheep were fed (which was so constructed that the dung and urine of the sheep fell through), and left there long enough to become well enriched. Other noted cultivators have recommended turfy loam and sheep or deer dung in the proportion of six of loam to three of the manure, one of leaf-mould being added. The compost should be prepared a considerable time beforehand, and frequently turned over and aerated; when used, it should be roughly broken with the spade, but not screened. Some cultivators, who do not otherwise enrich the soil, use half-inch bones and soot at the time of potting in the proportion of an 8-inch potful of each to a barrowful of fibrous surface soil. The plants when growing freely are benefited by the use of liquid manure of an ammoniacal character.

The pine-apple is sometimes propagated by planting the crowns which grow on the fruit, but more commonly from the suckers which appear at the base of the stem, these being a less time in arriving at a fruiting state. When removed from the fruit or stem, the crowns or suckers are trimmed and laid aside till the scar has dried, after which they are potted. This usually takes place during August or September, as the offsets should be allowed to obtain considerable bulk before they are removed, for the reason that large suckers grow with more vigour and come sooner into fruit than those of smaller size. They should be placed in 6-inch or 8-inch pots, the soil being somewhat lighter than that used afterwards. They may be slightly shaded for a short period, and in about eight or twelve days may receive a little water. The old routine of pine-apple culture embraced a period of three years, but this has been reduced by modern growers to about eighteen months.

The more rapid method was first brought into notice by Abercrombie. Its chief features are the employment of more mature suckers at the outset, and the acceleration of the growth of the plants afterwards by the application of a hotter and moister atmosphere than formerly, so as to obtain the growth of two summers in one.

The roots should be preserved in a fresh healthy state during winter, so as not to require being cut away, as was formerly done; and this may be secured by giving very moderate and judicious waterings, and by keeping the bottom heat well under control. About the beginning of March, or earlier, the forwardest young plants from suckers are selected from the stock of succession plants, and the earth and roots examined; they are then put into larger pots in good soil, and plunged in a bed having a genial bottom heat of about 85°. They require to be shaded for a few days, and after they begin to root should receive moderate waterings. Some growers shift at once into fruiting pots; but others give two shifts, and about the beginning of August transfer the plants into 10-inch or 12-inch pots, in which they will mature their fruit. Whether one or two shifts the ball of earth and roots is to be preserved entire. From March onwards the temperature is gradually increased as follows:—In March, 60° to 70° by night, 70° to 80° by day; April 70° to 75° by night, 80° to 85° by day; May 75° to 80° by night, 90° to 95° by day; June 80° to 85° by night, 95° to 100° by day. After the beginning of August the heat is allowed to decline gradually until it arrives at the winter temperature of 60°. While fire heat is used, the nocturnal temperature should not exceed 80°, and sufficient moisture must be supplied. To prevent the plants from being drawn, they should be allowed ample space—2 feet from plant to plant is not too much—and be placed as near the glass as possible. In August and September abundance of air and more copious supplies of water are given. To prevent the roots from damping off in winter, water must then be cautiously applied, and the pits should be heated by means of fire heat rather than by fermenting materials. Some gardeners apply this biennial mode of cultivation only to the varieties of the Queen type, but our best cultivators for the most part adopt it in its main features for all varieties, and the fruit produced is finer than that grown upon the triennial course. Those, however, who wish to cultivate such large and coarse-growing sorts as the Providence may possibly find it necessary to take a longer period for fruiting them.

The period at which pine-apple plants first show their fruit stems

is the most critical in their whole culture. The plant must be of a certain age, or at least of a certain magnitude, before it will start freely or to good purpose. In the second year a pine plant is capable of producing a perfect and well-swelled fruit, if during its growth it has been subjected to judicious treatment; the solid part of the stem is then observed to have increased in bulk, and to have ascended considerably above the soil. The start is generally required to be made at a particular period, but the young fruit does not appear until the pot is filled with roots. It is therefore necessary that the roots shall have nearly occupied all the new soil by the time the development of the fruit is required, and care should be taken that in winter the tender fibres should suffer neither from drought nor from excessive moisture or heat. After the plants show fruit they are never shifted; but the surface soil may be replaced by some fresh and rich compost. Water is supplied from time to time, but should never be colder than the average temperature of the house. Whilst the fruit is swelling, care must be taken to carry on the growth of the plant with equability and moderation. As the fruit approaches maturity, water is gradually withheld, lest the flavour should be impaired. Pine-apples should be cut a short time before they obtain complete maturity; they do not keep sound long after being cut, and consequently, if they have to be kept over for a short period the plant, pot and all, should be moved to a dryish moderately cool room.

The Hamiltonian system of pine growing was at one time more frequently adopted than now. Instead of the suckers being detached from their parent stems before fruiting, the base of the old stem was bared of leaves and earthed up with rich compost, into which it rooted freely, each sucker thus producing a ripe fruit in from eight to twelve months from the time it was started. When this fruit was cut, the process was repeated till a third succession of fruit and a fourth were obtained, after which the sucker which bore the last fruit was cut off with 6 or 8 inches of the main stem, and potted so as to furnish another similar progeny of suckers.

The Queen, as a quick-fruited sort, and the larger Smooth-leaved Cayenne, are the chief favourites among cultivators. It may, however, be useful to give the names of a few of the best varieties:—

Spineless-leaved Pine-apple.

Smooth-leaved Cayenne, fruit large, cylindrical: good in winter, Oct. to May.

Spiny-leaved Pine-apples.

Black Jamaica: fruit oval, 4 to 5 lb; one of the best for winter use.

Charlotte Rothschild: fruit cylindrical, 7 to 11 lb; good in winter.

Enville : fruit pyramidal, 6 to 7 lb.; best in summer, but second-rate.

Lady Beatrice Lambton : fruit pyramidal, 11 lb.; good in winter; very juicy.

Lord Carington : fruit cylindrical, 5 to 7 lb.; good in winter.

Prince Albert : fruit pyramidal, 6 to 8 lb.; swells freely in winter; very juicy.

Queen : fruit cylindrical, 4 to 8 lb.; the best sort for general purposes.

Thoresby Queen : fruit roundish-ovate, 6 to 8 lb.; high-flavoured.

The *Plum*, *Prunus domestica*, is considered a native of England, but many of the best cultivated varieties have been introduced from France. The fruit is not only prized for dessert, but also for culinary purposes.

Plums are propagated chiefly by budding on stocks of the Mussel, Brussels, St Julien, and Pear plums. The damson, wine sour, and other varieties, planted as standards, are generally increased by suckers. For planting against walls, trees which have been trained for two years in the nursery are preferred by some, but maiden trees can be very successfully introduced, and by a course of liberal treatment, with less hard pruning, may be more speedily got to a fruiting state.

Any good well-drained loamy soil is suitable for the plum, that of medium quality as to lightness being decidedly preferable. Walls with an east or west aspect are generally allotted to them, the distance between the trees being from 20 to 30 feet. The horizontal mode of training is adopted by many, but the fan or half-fan forms are also very commonly followed, and where there is sufficient height probably the fan system is the best. The shoots ought to be laid in nearly or quite at full length. The fruit is produced on small spurs on branches at least two years old, and the same spurs continue fruitful for several years. Standard plum trees should be planted 25 feet apart each way, and dwarfs 15 or 20 feet. Such trees require only to have a portion of their wood thinned out occasionally when they are young. The hardy kinds grown in this way are very productive.

In favourable seasons the crops require thinning, to relieve the branches from the excessive weight. The unripe fruit, if fully grown and beginning to change colour, is quite fit for cooking. For dessert purposes the fruit should be allowed to remain on the tree as long as it will hang, and should be gathered by the stalk without disturbing the bloom. Such kinds as Coe's Golden Drop and Ickworth Impératrice, if gathered dry, wrapped in tissue paper, and laid in a dry cool fruit-room, may be kept for months fit for use.

Mr Rivers has given us several very good sorts of orchard plums. The following is a selection of good reliable varieties of this fruit, with the season at which in ordinary seasons their fruit comes to maturity :—

Dessert Plums.

Early Green Gage.....	e. July.	Woolston Black.....	b. Sept.
Royal Hâtive	{ e. July.	Jefferson.....	b.m. Sept.
	{ b. Aug.	Kirke's.....	b.m. Sept.
Rivers's Early Apricot.....	b. Aug.	Hulings's Superb.....	m. Sept.
Denniston's Superb.....	m. Aug.	Reine Claude du Comte } m. Sept.	
Oullins Golden.....	m. Aug.	Hathem.....	
Green Gage.....	m.e. Aug.	Coe's Golden Drop.....	e. Sept.
M'Laughlin's.....	e. Aug.	Reine Claude de Bavay..	{ e. Sept.
Washington.....	Sept.		{ b. Oct.
Angellina Burdett.....	b. Sept.	Ickworth Impératrice	b. Oct.
Purple Gage.....	b. Sept.	Late Rivers.....	{ e. Oct.
Transparent Gage.....	b. Sept.		{ b. Nov.

Culinary Plums.

Early Rivers.....	e. July.	White Magnum Bonum....	Sept.
Early Orleans.....	b.m. Aug.	Mitchelson's.....	b. Sept.
Czar.....	m. Aug.	Pond's Seedling	b.m. Sept.
Sultan.....	m. Aug.	Victoria (Alderton).....	b.m. Sept.
Pershore.....	m.e. Aug.	Crittenden's Damson.....	m. Sept.
Orleans.....	e. Aug.	Diamond	m. Sept.
Prince Engelbert	{ e. Aug.	Wine Sour.....	m. Sept.
	{ b. Sept.	Autumn Compôte.....	e. Sept.
Prince of Wales	{ e. Aug.	Sandall's	e. Sept.
	{ b. Sept.	Belle de Septembre.....	b.m. Oct.

The *Quince*, *Cydonia vulgaris*, is but little cultivated in Great Britain, two or three trees planted in the slip or orchard being in general found to be sufficient for a supply of the fruit; in Scotland it seldom approaches maturity, unless favoured by a wall. The fruit has a powerful odour, but in the raw state is austere and astringent; it, however, makes an agreeable marmalade, and is often used to give flavour and poignancy to stewed or baked apples.

The quince prefers a rich light and somewhat moist soil. The tree is generally propagated by cuttings or layers, the former making the best plants, but being longer in growing. It is much used as a dwarfing stock for certain kinds of pears, and for this purpose the young plants when bedded out in the quarters should be shortened back to about 18 or 20 inches. Those required to form standard fruit-bearing trees should be trained up to a single stem till a height of 5 or 6 feet is attained.

There are three principal varieties of the quince, the Portugal, the apple-shaped, and the pear-shaped. The Portugal is a taller and more vigorous grower than the others, and has larger and finer fruit; the apple-shaped, which has roundish fruit, is more productive, and ripens under less favourable conditions than either of the

others ; while the pear-shaped has roundish-pyriform fruit ripens later than that of the apple-shaped variety.

The *Raspberry*, *Rubus Idæus*, which is found wild in Britain and in woods throughout Europe and Asiatic Russia, is propagated from suckers, which may be taken off the parent in October, and planted in rows 5 or 6 feet apart, and asunder in the rows. It is the habit of the plant to throw the root every year a number of shoots or canes, which bear in the subsequent year, and then decay. In dressing the plants, done immediately after the crop is gathered, all these extra stems are cut away, and of the young canes only three or four strongest are left, which are shortened about a third. The being too weak to stand by themselves, are sometimes connected together by the points in the form of arches, or a stake is driven midway between the plants, and half the canes are bent one half the other both being tied to the stake. Sometimes they are kept upright to stakes fixed to each stool. The best support is, however, obtained by fastening the ends of the shoots to a slight horizontal rail or bar, placed a foot and a half on the south side of the row, by which means the bearing shoots are deflected from the perpendicular to the sunny side of the row, and are not shaded by the annual wood. When this mode of training is adopted, the plants should be planted 1 foot apart in the row and leaving one or two only to each shoot is preferable. The ground between the plants should never be disturbed by digging ; but an abundant supply of good manure should be given annually in autumn and be forked in. All surplus suckers should be got away early in the summer, as they have robbed the roots, —five or six, to be reduced to the five being reserved to each root. Fresh plantations of raspberries should be made every six or seven years. The double-bearing varieties which continue to fruit during autumn, require light soils and open situations. These should be cut close down in February, and the strong young shoots of the current year which bear autumnal crops. The other varieties may be made to bear in autumn by cutting the stems half-way down at an early period in the autumn, but, as with all other fruits, the flavour of the raspberry is best when it is allowed to ripen at its natural season.

The following are some of the finer sorts now in cultivation

Baumforth's Seedling—a large summer-bearing red.
Carter's Prolific—a large summer-bearing red.

Fastolf or Filby—a large summer-bearing red.
 M'Laren's Prolific—a large double-bearing red
 Northumberland Fillbasket—a large summer red.
 October Red—a fine autumn-bearing red.
 October Yellow—a fine autumn-bearing yellow.
 Prince of Wales—a large summer-bearing red.
 Red Antwerp—a large summer-bearing red.
 Rogers's Victoria—a large autumn-bearing red.
 Round Antwerp—a large summer-bearing red.
 Sweet Yellow Antwerp—a large summer-bearing yellow.

The *Service*, *Pyrus Sorbus* or *P. domestica*, is a European tree which has been regarded as a native of England on the evidence of a single tree, which has probably been planted, now existing in the forest of Wyre. Though not much cultivated, its fruit is esteemed by some persons, and therefore two or three trees may very well be provided with a place in the orchard, or in a sheltered corner of the lawn. The tree is seldom productive till it has arrived at a goodly size and age. The fruit has a peculiar acid flavour, and, like the medlar, is fit for use only when thoroughly mellowed by being kept till it has become bletted. There is a pear-shaped variety, *pyriformis*, and also an apple-shaped variety, *maliformis*, both of which may be propagated by layers, and still better by grafting on seedling plants of their own kind. The fruit is sometimes brought to market in winter.

The *Strawberry* of the garden has been obtained by the crossing of several species of *Fragaria*, the larger-fruited sorts from *F. grandiflora*, *chilensis*, and *virginiana*, and the smaller alpine from *F. vesca*. The alpine varieties should be raised from seeds; while the other sorts are continued true to their kinds by runners. If new varieties are desired, these are obtained by judicious crossing and seeding.

The seeds of the alpine should be saved from the finest fruit ripened early in the summer. They should at once be sown, either in a sheltered border outdoors or in pots. The soil should be rich and light, and the seeds very slightly covered by sifting over them some leaf-mould or old decomposed cow dung. When the plants appear and have made five or six leaves, they should be transplanted to where they are to remain for bearing. The seeds sown in pots may be helped on by gentle heat, and when the plants are large enough should be pricked out in fine rich soil, and in June transferred to the open ground for bearing; they will produce a partial crop in the autumn, and a full one in the following season. The same treat-

ment may be applied to the choicer seedlings of the larger-fruited sorts from which new varieties are expected.

The runners of established sorts should be allowed to root in the soil adjoining the plants, which should, therefore, be kept light and fine, and as soon as a few leaves are produced on each the secondary runners should be stopped. When the plants have become well-rooted, they should at once be planted out. They do best in a rather strong loam, and should be kept tolerably moist. The scarlet section prefers a rich sandy loam. The ground should be trenched 2 or 3 feet deep, and supplied with plenty of manure, a good proportion of which should lie just below the roots, 10 or 12 inches from the surface. The plants may be put in on an average about 2 feet apart. Mr Myatt, a well-known strawberry-grower for market, plants in rows 18 inches apart, and the same distance from plant to plant in the rows, but leaves a space of 80 inches for an alley separating groups of three rows, and after the first year the middle row is cleared away. Some of the best growers allow 2½ feet between the rows, with the plants 2 feet from each other.

A mulching of strawy manure put between the rows in spring serves to keep the ground moist and the fruit clean, as well as to afford nourishment to the plants. Unless required, the runners are cut off early, in order to promote the swelling of the fruit. The plants should be watered during dry weather after the fruit is set, and occasionally till it begins to colour. As soon as the fruit season is over, the runners are again removed, and the ground hoed and raked. The plantation should be renewed every second or third year, or less frequently if kept free of runners, if the old leaves are cut away after the fruit has been gathered, and if a good top-dressing of rotten dung or leaf-mould is applied. A top-dressing of loam is beneficial if applied before the plants begin to grow in spring, but after that period they should not be disturbed during the summer either at root or at top. If the plants produce a large number of flower-scapes, each should, if fine large fruit is desired, have them reduced to about four of the strongest. The lowest blossoms on the scape will be found to produce the largest, earliest, and best fruits. The fruit should not be gathered till it is quite ripe, and then, if possible, it should be quite dry, but not heated by the sun. Those intended for preserving are best taken without either the stalk or the calyx.

Forcing.—The runners propagated for forcing are layered into 3-inch pots, filled with rich soil, and held firm by a peg or stone. If

kept duly watered, they will soon form independent plants. The earlier they are secured the better. When firmly rooted they are removed and transferred into well-drained 6-inch pots, of strong well-enriched loam, the soil being rammed very firmly into the pots, which are to be set in an open airy place. In severe frosts they should be covered with dry litter or bracken, but do not necessarily require to be placed under glass. They are moved into the forcing houses as required. The main points to be kept in view in forcing strawberries are, first, to have strong stocky plants, the leaves of which have grown sturdily from being well exposed to light, and secondly, to grow them on slowly till fruit is set. When they are first introduced into heat, the temperature should not exceed 50° by fire heat, and fresh air must be freely admitted; should the leaves appear to grow up thin and delicate, less fire heat and more air must be given, but an average temperature of 55° to 60° by day may be allowed, and continued while the plants are in flower. When the fruit is set the heat may be gradually increased, till at the ripening period it stands at 65°, and occasionally at 75° by sun-heat. While the fruit is swelling the plants should never be allowed to get dry, but when it begins to colour no more water should be given than is absolutely requisite to keep the leaves from flagging. The plants should be removed from the house as soon as the crop is gathered. The forced plants properly hardened make first-rate outdoor plantations, and if put out early in summer, in good ground, will often produce a useful autumnal crop.

The varieties are very numerous. The following are some of the best and most distinct of those now in cultivation, those marked * being specially suitable for forcing:—

- Amateur—a brisk-flavoured variety.
- British Queen*—one of the best-flavoured sorts; requires good cultivation.
- Dr Hogg—a hardier form of British Queen.
- Elton—late, and valuable for preserving.
- Enchantress—a fine-flavoured late variety.
- Filbert Pine*—an excellent high-flavoured sort.
- Frogmore Late Pine—a good late sort.
- James Veitch*—a large solid showy variety.
- Keens' Seedling*—a fine old sort, of great merit for all purposes.
- La Constante*—an excellent sort, of sprightly flavour.
- La Grosse Sucrée*—large, and of excellent flavour.
- Loxford Hall Seedling—one of the best late sorts.
- Lucas*—a useful fine-flavoured variety.
- Myatt's Eliza—very high-flavoured, perhaps in this respect unequalled.
- Oscar*—good for a general crop; travels well.
- President*—a useful brisk-flavoured sort.

Sir Charles Napier*—a capital market fruit, rather acid.

Sir Harry—a favourite market fruit.

Sir Joseph Paxton*—an excellent large high-flavoured sort.

Vicomtesse Héricart de Thury*—good for all purposes; one of the best.

The *Vine*, *Vitis vinifera*, a native of the shores of the Caspian, and a deciduous climbing shrub, is hardy in Britain so far as regards its vegetation, but not hardy enough to bring its fruit to satisfactory maturity, so that for all practical purposes the vine must be regarded as a tender fruit. Planted against a wall or a building having a south aspect, or trained over a sunny roof, such sorts as the Black Cluster, Black Prince, Pitmaston White Cluster, Royal Muscadine, Sweetwater, &c., will ripen in the warmest English summers so as to be very pleasant eating, but in cold summers the fruit is not eatable in the raw state, and can only be converted into wine or vinegar. For outdoor culture the long-rod system is generally preferred.

When the plant is grown under glass, the vine border should occupy the interior of the house and extend outwards in the front, but it is best made by instalments of 5 or 6 feet as fast as the previous portions become well filled with roots, which may readily be done by packing up a turf wall at the extremity of the portion to be newly made; an exterior width of 15 feet will be sufficient. Inside borders require frequent and thorough waterings. In well-drained localities the border may be partially below the ground level, but in damp situations it should be made on the surface; in either case the firm solid bottom should slope outwards toward an efficient drain. A good bottom may be formed by chalk rammed down close. On this should be laid at least a foot thick of coarse hard rubbly material, a layer of rough turf, grass side downwards, being spread over it to prevent the compost from working down. The soil itself, which should be $2\frac{1}{2}$ or 3 feet deep, never less than 2 feet, should consist of five parts rich turfy loam, one part old lime rubbish or broken bricks, including a little wood ashes or burnt earth (ballast), one part broken charcoal, and about one part of half-inch bones, the whole being thoroughly mixed, and kept dryish till used.

Young vines raised from eyes are generally preferred for planting. The eyes being selected from well-ripened shoots of the previous year are planted about the end of January, singly, in small pots of light loamy compost, and after standing in a warm place for a few days should be plunged in a propagating bed, having a bottom heat of 75° ,

which should be increased to 85° when they have produced several leaves, the atmosphere being kept at about the same temperature or higher by sun heat during the day, and at about 75° at night. As soon as roots are freely formed the plants must be shifted into 6-inch pots, and later on into 12-inch ones. The shoots are trained up near the glass, and, with plenty of heat (top and bottom) and of water, with air and light, and manure water occasionally, will form firm strong well-ripened canes in the course of the season. To prepare the vine for planting, it should be cut back to within 2 feet of the pot early in the season, and only 3 or 4 of the eyes at the base should be allowed to grow on. The best time for planting is in spring, when the young shoots have just started. The vines should be planted inside the house, from 1 to 2 feet from the front wall, the roots being placed an inch deeper in the soil than before, carefully disentangled and spread outwards from the stem, and covered carefully and firmly with friable loam, without manure. When the shoots are fairly developed, the two strongest are to be selected and trained in. When forcing is commenced, the vinery is shut up for two or three weeks without fire heat, the night temperature ranging about 45°. Fire heat must be at first applied very gently, and may range from 50° to 55° at night, and from 60° to 65° by day; a few degrees more may be given as the buds break and the new shoots appear. When in flower, and onwards during the swelling of the berries, 65° to 70° may be taken as a minimum, running up to 85° by day, or to 90° with sun heat. The temperature may be lowered somewhat when the fruit is ripe. Muscats and other tender sorts require a rather higher range of temperature. As much ventilation as the weather will permit should be given. A moist atmosphere is necessary for the swelling fruit and for maintaining the health of the foliage, and may be kept up by the use of evaporating troughs and by syringing the walls and pathways twice or thrice a day, but the leaves should not be wetted. When the vines are in flower, and when the fruit is colouring, the troughs should be kept dry, but the aridity must not be excessive, lest the red spider and other hurtful insects should attack the leaves. In the course of the season the borders (inside) will require several thorough soakings of warm water,—the first when the house is shut up, this being repeated when the vines have made young shoots a few inches long, again when the vines are in flower, and still again when the berries are taking the second swelling after stoning. Outside borders require watering in very dry summer weather only.

There are three principal systems of pruning vines, termed the *long-rod*, the *short-rod*, and the *spur* systems, and good crops have been obtained by each of them. It is admitted that larger bunches are generally obtained by the long-rod than by the spur system. The principle of this mode of pruning is to train in at considerable length, according to their strength, shoots of the last year's growth for producing shoots to bear fruit in the present; these rods are afterwards cut away and replaced by young shoots trained up during the preceding summer; and these are in their turn cut out in the following autumn after bearing, and being replaced by shoots of that summer's growth. By the short-rod system, short instead of long rods are retained; they are dealt with in a similar manner. The spur system has, however, become the most general. In this case the vines are usually planted so that one can be trained up under each rafter, or up the middle of the sash, the latter method being preferable. The shoots are cut back to buds close to the stem, which should be encouraged to form alternately at equal distances right and left, by removing those buds from the original shoot which are not conveniently placed. The young shoots from these buds are to be gently brought to a horizontal position, by bending them a little at a time, and usually opposite about the fourth leaf the rudiments of a bunch will be developed. The leaf directly opposite the bunch must in all cases be preserved, and the young shoot is to be topped at one or two joints beyond the incipient fruit, the latter distance being preferable if there is plenty of room for the foliage to expand; the lateral shoots, which will push out after the topping, must be again topped above their first or second joints. If the bunches are too numerous they must be thinned before the flowers expand, and the berries also must be properly thinned out and regulated as soon as they are well set, care being taken, in avoiding overcrowding, that the bunches be not made too thin and loose.

The cultivation of vines in pots is very commonly practised with good results, and pot-vines are very useful to force for the earliest crop. The plants should be raised from eyes, and grown as strong as possible in the way already noted, in rich turfy loam mixed with about one-third of horse dung and a little bone dust. The temperature should be gradually increased from 60° to 80°, or 90° by sun heat, and a bottom heat a few degrees higher must be maintained during their growth. As the roots require more room, the plants should be shifted from 3-inch pots into those of 6, 12, or 15 inches in diameter, in any of which larger sizes they may be fruited in the

following season, but, to be successful in this, the young rod produced must be thoroughly matured after it has reached its limit of growth. Mr Rivers has grown them very successfully by standing the pots on the hot-water pipes, as shown in fig. 175, which represents a portion of one of his heated orchard houses.

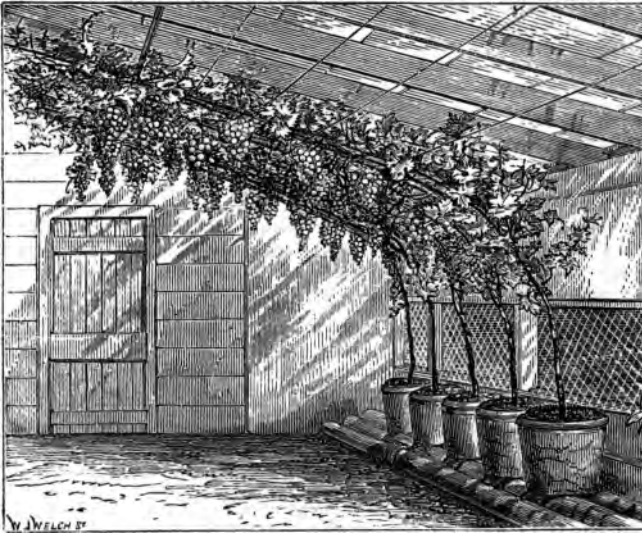


FIG. 175.—Vines in pots, set on hot-water pipes.

The vine, both indoors and out, is very subject to the vine-mildew, which appears to the naked eye like a white powder; when this is visible there is no effectual remedy, but if taken at the earliest stage it may be destroyed by dusting the whole plant, stem, leaves, and fruit, with sulphur. An equally destructive enemy is the vine louse, *Phylloxera vastatrix*. No certain easily applied cure has yet been discovered, and practically the only sure remedy is to destroy the vines, clear out the old infested soil, and cleanse the structures thoroughly in every part.

The number of varieties of grapes possessing some merit is considerable, but a very few of them will be found sufficient to supply all the wants of the cultivator. For general purposes nothing

approaches the Black Hamburg (including Frankenthal) in merit. Those named below are more or less in requisition:—

Outdoor Grapes.

- Black Cluster—small, roundish-oval, black berries.
- Black Prince—largish, oval, purplish-black berries.
- Early Ascot Frontignan—round, amber-coloured berries; musky flavour.
- Early Saumur Frontignan—medium, round, pale-amber berries; musky.
- Early White Malvasia (Grove-end Sweetwater)—roundish, whitish-green berries.
- Espiran—large, round, blackish-purple berries.
- July Frontignan—medium, round, blue-black berries; musky flavour.
- Miller's Burgundy (The Miller)—small, roundish-oval, black berries.
- Royal Muscadine (Chasselas de Fontainebleau)—large, round, greenish-yellow berries; one of the best white grapes, indoors or out.

Indoor Grapes.

- Alicante—large, oval, blue-black berries; late, and a good keeper.
- Black Hamburg—large, roundish-oval, black berries; A 1 in every respect.
- Black Monukka—medium, obovate-oblong, brownish-black, seedless, crackling berries; very pleasant eating; may be grown as a curiosity.
- Buckland Sweetwater—large, roundish, pale amber berries.
- Canon Hall Muscat—large, roundish, amber berries; high musky flavour.
- Chasselas Musqué—medium, round, pale amber berries; rich musky flavour.
- Dr Hogg—medium, round, transparent amber berries; musky.
- Duke of Buccleuch—very large, roundish, greenish-amber berries.
- Foster's White Seedling—largish, roundish-oval, greenish-yellow berries.
- Frankenthal (Victoria Hamburg)—large, roundish-oblate, black berries.
- Grizzly Frontignan—medium, round, grizzly red berries; musky.
- Gros Colman—very large, round, black berries; late, requires to hang long.
- Gros Maroc—large, oval, purple-black berries; very fine, late.
- Lady Downe's—largish, roundish-oval, black berries; late, a good keeper.
- Madresfield Court—large, oval or oblong, black berries; slightly musky.
- Mill Hill Hamburg—very large, round or oblate, hammered, blue-black.
- Muscat of Alexandria—large, oval, pale-amber berries; musky flavour.
- Muscat Hamburg—large, oval, black berries; musky flavour.
- Raisin de Calabre—large, round, transparent white berries; late.
- Trebbiano—medium, roundish-oval, greenish-white berries; late.
- Venn's Black Muscat—medium, oval, brownish-black berries; musky.
- West's St Peter's—largish, roundish-oval, blue-black berries; late.
- White Frontignan—medium, round, greenish-yellow berries; musky.

For the open wall, the Early Ascot Frontignan, Early White Malvasia, and Royal Muscadine may be preferred of the white sorts; and July Frontignan and Black Prince of the blacks. For a greenhouse vinery, Black Hamburg and Madresfield Court, black; and Foster's White Seedling, Buckland Sweetwater, and Royal Muscadine, white. For early forcing, Black Hamburg and Muscat Hamburg, black; Foster's White Seedling, Royal Muscadine, White Frontignan, and Duke of Buccleuch, white. For a general mid-season crop, Black Hamburg or Frankenthal, and Mill Hill Hamburg, black; Grizzly Frontignan, reddish; and Muscat of Alexandria and Raisin de Calabre, white. For hanging late, Alicante, Gros Colman, Gros Maroc, Lady Downe's, and West's St Peter's, black; and Muscat of Alexandria and Trebbiano, white.

The *Walnut*, *Juglans regia*, is a lofty tree, native of Persia and Asia Minor. The fruit, whilst young and tender, is much used for pickling, and when ripe is a favourite article of the dessert. The tree succeeds in deep sandy or calcareous loams, and in stiff loams resting on gravel. It is propagated by seeds, and by budding, grafting, or inarching for the perpetuation of special varieties. The trees form their heads naturally, and therefore little pruning is required, it being merely necessary to cut off straggling growths, and to prevent the branches from interlacing. The best time for performing this is in the autumn, just after the fall of the leaf. Plants raised from the seed seldom become productive till they are twenty years old. The fruit is produced at the extremities of the shoots of the preceding year; and therefore, in gathering the crop, care should be taken not to injure the young wood. In some parts of England the trees are thrashed with rods or poles to obtain the nuts, but this is far from being a commendable mode of collecting them.

Besides the common walnut, there are several varieties cultivated, particularly the Thin-shelled and the Thetford or Highflyer, which last is by far the best walnut grown.

Orchard-house Trees.—The fruits that may be successfully grown in unheated orchard-houses are peaches, nectarines, apricots, plums, figs, cherries, pears, and apples; and all, except the last two, are more readily obtained in those which are judiciously heated.

The trees are sometimes planted out, and sometimes grown in pots. The potted trees are decidedly to be preferred, for those which are planted out are less at the command of the cultivator, and unless the houses are large are apt to outgrow the space; they do not indeed require so much attention as regards water, while pot trees entail very much labour in this respect from the time the fruit is fairly set until it is near the ripening stage; but on the other hand a much greater variety may be grown in this way, and the trees can be shifted from place to place, as required, with the utmost facility. While at rest in winter they can be set close together without injury, and may be continued in this way until they come into flower. After the setting of the fruit, the hardier sorts, as plums, pears, and apples, can be taken out, and put under temporary awnings till it is safe to plunge them beside the walks in the open quarters of the garden, where they grow and swell, if duly watered, as well as if established in the ground. In dry summer weather they need a good watering two or three times a day, and besides this should have a dose of

liquid manure occasionally. This removal of the hardier plants to the open air leaves more space under glass for the tenderer sorts.

The trees are most convenient when trained in the pyramidal form (fig. 176), or as compact bushes (fig. 166); and the summer treatment should consist in pinching back the points of all the growing shoots after they have formed two or three leaves.

The vigour of pot fruit trees is greatly due to judicious surface-dressing during the summer months. It should be applied at intervals of ten or twelve days, and should be made up of equal parts of horse-droppings, turfy loam, and malt dust, the whole being laid up in a heap and frequently turned. The dressing should not, however, be applied within three weeks of the ripening of the fruit. The trees should be repotted in autumn as soon as the leaves have done their work, in similar compost to that first employed — good turfy loam, with about a sixth of rotted manure, and a sprinkling of bone dust. They are to be turned out of the pot, and a slice of about an inch in thickness pared off with a sharp knife, and are then to be replaced in a pot of the same size as that in which they previously grew, unless in those cases where a larger one may be afforded, and then the roots need not be cut away. This disrooting may sometimes be done before the leaves are quite ready to fall, in which case care is necessary to prevent the tree from flagging; and, if the weather be hot, the tops should be kept moist by frequently dewing the foliage with the syringe, but no water must be given at the root for a day or two after repotting. If the wood has been well ripened,



FIG. 176.—Pyramid Peach; Rivers' Early York.

trees treated in this way will bear freely during the following season. Whether placed on the floor of the house, or plunged outdoors, the pots should stand on two bricks placed a little apart, so that worms cannot gain admittance by the draining-hole.

The fruit obtained from trees well cultivated in pots in an orchard-house will compare, as regards size and quality, with the best fruit ripened on an open wall or in a forcing-house; but, when grown without fire heat, it is of course but little in advance of the outdoor crops. To the amateur this mode of culture will be found to present many attractions.



CHAPTER VIII.

VEGETABLES.



UNDER this head we shall first treat of those esculents which are largely eaten as "vegetables" or as "salads," while the various "herbs" which are used chiefly for flavouring or garnishing will be referred to in a supplementary paragraph.

The *Artichoke*, *Cynara Scolymus*, is a stout-growing hardy perennial, cultivated for the sake of the immature flower-heads. In France the whole of the leaves of the involucre are eaten when in a young and tender state, *en poivrade*, or with pepper, salt, and vinegar; but the only parts of the flower-head used in England are the base of the leaves of the involucre, and the immature floral receptacle called the *bottom*, freed from the bristly seed-down which is called the *choke*. In plantations about to be destroyed the central leaves are sometimes blanched and eaten; this edible part, like that of the nearly related cardoon (page 367), is called the *chard*.

The artichoke requires a deep cool dry soil, well enriched, and deeply trenched. It is propagated by parting the roots in April, the sets being planted in rows 4 or 5 feet asunder, and 2 feet apart in the rows. As the young plants afford a crop which succeeds that of old plants, a new plantation is made in some gardens every year. During summer the artichokes require little other attention than to be kept clear of weeds. In November the decayed stems and leaves are removed, the ground cleared, and a cone of a foot deep of sifted coal-ashes, or rotten tan, or littery dung, is placed close round the base to defend the stools from frost. In April this is taken away, the stocks are examined, and two or three only of the strongest shoots are permitted to remain; a dressing of manure is given—well-rotted hotbed dung or seaweed—and the ground

between the rows is forked over. The offsets, carefully removed, afford materials for young plantations. The heads are cut when nearly full grown, as shown in the accompanying illustration.

The varieties most esteemed are the Large Green Laon (fig. 177), which has conical heads, and is considered the highest flavoured; the Globe, which has dull purplish heads, and is well adapted for a general crop; and the Purple, which is the earliest. The Laon is that usually grown around Paris.



FIG. 177.—Artichoke; Large Green Laon.

The *Asparagus*, *Asparagus officinalis*, is one of the most delicate of our esculents, possessing well-marked diuretic properties, and is grown extensively in private gardens as well as for market. The asparagus prefers a loose light deep sandy soil; the depth should be 3 feet, the soil being well trenched, and all surplus water got away. A considerable quantity of well-rotted dung or of recent seaweed should be laid in the bottom of the trench, and another top-dressing of manure should be dug in preparatory to planting or sowing. Nitrate of soda appears to be the best artificial manure, and salt applied at the rate of 2 lb to the square yard is a good dressing while the plants are growing. The beds should be 3 feet or 5 feet wide, with intervening alleys of 2 feet, the narrower beds taking two rows of plants, the wider ones three rows. The beds should run east and west, so that the sun's rays may strike against the side of

the bed. In some cases the plants are grown in equidistant rows 3 to 4 feet apart. Where the beds are made with plants already prepared, either one-year old or two-year old plants may be used, for which a trench should be cut sufficient to afford room for spreading out the roots, the crowns being all kept at about 2 inches below the surface. Planting is best done in May, after the plants have started into growth. To prevent injury to the roots, it is, however, perhaps the better plan to sow the seeds in the beds where the plants are to remain.

The seed should be sown in March in slight drills; and it is a good precaution to sow more than is necessary, and to thin out towards the end of the first summer, to the distance of about 6 inches in the rows. The ground must be hoed and kept clear of weeds. Frequently slight crops of lettuce are taken from the surface of the beds, and of cauliflower from the spaces between them. The asparagus heads should not be cut before the third spring, and are not in perfection till the fourth or fifth.

The manuring of asparagus, which can scarcely be overdone, should be performed in the end of autumn, when the dead stems are removed. When the plants are in beds, the surface should be stirred with a fork; a layer of well-rotted hotbed dung should then be laid on, and the whole covered with a sprinkling of earth from the alleys. If the plants are grown in rows, the manure is simply dug in between them by means of a digging fork, care being taken not to injure the roots. These operations are repeated annually, and no other culture is required; but it is necessary to observe a due moderation in reaping the crop, as the shoots, when cut too freely, become gradually smaller. A considerable quantity of ground is consequently required to keep up a supply. It is a general rule never to gather asparagus after peas have come into season. To experience the finest flavour of asparagus, it should be eaten immediately after having been gathered; if kept longer than one day, or set into water, its finer flavour is altogether lost. If properly treated, asparagus beds will continue to bear well for many years.

The asparagus grown at Argenteuil, near Paris, has acquired much notoriety for its large size and excellent quality. The French growers plant in trenches, instead of raised beds.

Forcing.—The most common method of forcing asparagus is to prepare, early in the year, a moderate hotbed of stable litter with a bottom heat of 70°, and to cover it with a common frame. After the heat of fermentation has somewhat subsided, the surface of the bed

is covered with a layer of light earth or exhausted tan-bark, and in this the roots of strong mature plants are closely placed. The crowns of the roots are then covered with 3 to 6 inches of soil. A common three-light frame may hold 500 or 600 plants, and will afford a supply for several weeks. After planting, linings are applied when necessary to keep up the heat, but care must be taken not to scorch the roots; air must be occasionally admitted. Where there are pits heated by hot water or by the tank system, they may be advantageously applied to this purpose. A succession of crops must be maintained by annually sowing or planting new beds. Mr Lindegard, of the Royal Gardens at Copenhagen, recommends the plan of forcing asparagus on the ground on which it grows, but the results obtained in this way are not so satisfactory.

The principal varieties are the Red-topped and the Green-topped, of which there are several reputed sub-varieties, as the Battersea, Gravesend, Giant Colossal, &c., which differ but slightly from each other.

The *Bean*, *Faba vulgaris*, is an annual plant. The seeds are sown about 4 inches apart, in drills $2\frac{1}{2}$ feet asunder for the smaller and 3 feet for the larger sorts. The soil should be a rather heavy loam, deeply worked and well enriched. For an early crop Beck's Dwarf Green Gem, or the Royal Dwarf Fan may be sown in November, and protected during winter in the same manner as early peas. An early crop may also be obtained by dibbling in the seeds in November, sheltering by a frame, and in February transplanting them to a warm border. Successional crops of Early Seville or Early Longpod should be sown in January and February, and the Longpods or Green Windsor in March, April, and May, for a general crop, while for later crops the Mammoth Longpod may be sown in June or early in July. All the culture necessary is that the earth be drawn up about the stems. The plants are usually topped when the pods have set, as this not only removes the black aphides which often settle there, but is also found to promote the filling of the pods.

The following are some of the best sorts:—

Early.—Beck's Dwarf Green Gem, Marshall's Early Dwarf Prolific, Royal Dwarf Fan, Early Seville, Early Longpod.

Late.—Windsor, Green Windsor, Mammoth Longpod.

The *Beet*, *Beta vulgaris*, is a hardy biennial, native of the south of Europe, on the sea-coast. The boiled root is eaten cold, either by itself or as a salad; it is also often used as a pickle. The

beet prospers in a rich deep soil, well pulverized by the spade. If manure is required, it should be deposited at the bottom of the trench in preparing the ground. The seeds should be sown in drills 15 inches asunder, in April or early in May, and the plants are afterwards to be thinned to about 8 inches apart in the lines, but not more, as moderate-sized roots are preferable. The plants should grow on till the end of October or later, when a portion should be taken up for use, and the rest laid in in a sheltered corner, and covered up from frost. The roots must not be bruised, and the leaves must be twisted off—not closely cut, as they are then liable to bleed. In the north the crop may be wholly taken up in autumn, and stored in a pit or cellar, beyond reach of frost. If it is desired to have fresh



FIG. 178.—Beet; Egyptian, or Early Round Red.



FIG. 179.—Beet; Red Castlenaudary.

roots early, the seeds should be sown at the end of February or beginning of March; and if a succession is required, a few more may be sown by the end of March.

The Yellow Beets are not appreciated at table, and the White Sugar Beets are not suitable for garden culture. We shall only name a selection of the red-fleshed sorts:—Egyptian, or Early Round Red (fig. 178), very early; Red Castlenaudary (fig. 179), the type of our best long beets; Pine-apple Short-top, Nutting's Selected, Carter's Perfection of Beets, Sutton's Dark Red, Dell's Crimson or Osborn's Select.

The White Beet, *Beta Cicla*, is cultivated for the leaves, which are used as spinach; but for this they are a very sorry substitute. The midribs and stalks of the leaves are also stewed and eaten as sea-

kale, under the name of Swiss chard. The culture does not differ materially from that of the red beet, but more space is required.

The *Borecole* or *Kale*, *Brassica oleracea acephala*, includes several varieties which are amongst the hardiest of our esculents, and seldom fail to yield a good supply of winter greens. They require well-enriched soil, space for full exposure to air, and to be sown early, so as to be well established and hardened before winter.

The main crop should be sown about the first week of April, or, in the north, in the third week of March, and a succession a month later. The Buda kale is sown in May, and planted out in September, but a sowing for late spring use may be made in the last week of August, and transplanted towards the end of September. To prevent overcrowding, the plants should be transplanted as soon as they are of sufficient size, but if the ground is not ready to receive them a sufficient number should be pricked out thinly in some open spot. In general the more vigorous sorts should be planted in rows $2\frac{1}{2}$ feet or 3 feet and the smaller growers 2 feet apart, and 18 inches from plant to plant. In these the heads should be first used, only so much of the heart as is fresh and tender being cut out for boiling; side shoots or sprouts are afterwards produced for a long time in succession, and may be used so long as they are tender enough to admit of being gathered by snapping their stalks asunder.

The best of the borecoles or kales are—Dwarf Green Curled or Scotch Kale, very hardy, and from its dwarf habit often sheltered by snow; Cotta's Kale, very hardy, one of the most prolific and well-flavoured; Purple Borecole, very hardy. The following are less vigorous in growth, but are of excellent quality:—Jerusalem Kale, Egyptian Kale, Buda Kale, the last two very hardy.

The *Broccoli*, *Brassica oleracea botrytis asparagoides*, is supposed to have sprung from the cauliflower, being, like it, of Italian origin, and differing chiefly in possessing greater hardiness of constitution. Miller, however, states (*Gardeners' Dictionary*) that the broccolis known in his time were imported from the island of Cyprus.

The broccoli succeeds best in a fresh, loamy soil, somewhat firm in texture. For the autumn broccolis the ground can scarcely be too rich, but the winter and spring sorts, on ground of this character, are apt to become so succulent and tender that the plants suffer from frost even in sheltered situations, while plants less stimulated by manure and growing in the open field may be nearly all saved, even in severe winters. The main crops of the early sorts, for use in

autumn, such as the Cape varieties, Grange's, &c., should be sown early in May, and planted out while young, to prevent them coming too early into flower; in the north they may be sown a fortnight earlier. The later sorts, for use during winter and spring, should be sown about the middle or end of May, or about ten days earlier in the north. The seed beds should be made in fresh light unexhausted soil; and if the season be dry, the ground should be well watered before sowing. If the young plants get at all crowded, they should be thinned out. The ground should not be dug before planting them out, as the firmer it is the better; but a shallow drill may be drawn to mark the lines. The larger-growing sorts may be put in rows 3 feet apart, and the plants about $2\frac{1}{2}$ feet apart in the rows and the smaller-growing ones at from 2 to $2\frac{1}{2}$ feet between, and $1\frac{1}{2}$ to 2 feet in the rows. If the ground is not prepared when young plants are ready for removal, they should be transferred to nursery beds and planted at 3 to 4 inches apart, but the earlier they can be got into their permanent places the better.

It is of course the young flower-heads of the plant which are eaten. When these form, they should be shielded from the light by bending or breaking down an inner leaf or two, though in some of the sorts the leaves naturally curve over the heads. To prevent injury to the heads by frost in severe winters, the plants should be laid in with their heads sloping towards the north, the soil being thrown back so as to cover their stems; or they may be taken up and laid in closely in deep trenches, so that none of the lower bare portion of the stem may be exposed. Some dry fern or litter may also be laid over the tops.

The spring varieties are extremely valuable, as they come at a season when the finer vegetables are scarce. They afford a supply from March to May inclusive. In all cases great care should be taken to procure the seed true, as it is very liable to become deteriorated through being crossed by insect agency.

The following are good types of broccoli, but the varieties are frequently changing, in name at least, the supposed novelties being often merely good and pure stocks of older kinds:—

For autumn and early winter use: Early Purple Cape, Early White Cape, Grange's, Veitch's Self-protecting Autumn, Snow's Superb Winter White, Osborn's Winter White, Backhouse's Winter.

For late winter and spring use: Knight's Protecting, Cooling's Matchless, Leamington, Chappel's Cream, Elliotson's Mammoth, Sutton's Perfection, Penzance, Purple Sprouting.

For the latest supply: Cattell's Eclipse, Carter's Champion, Lauder's Goshen, Late White Protecting, Miller's Dwarf Late White.

The *Brussels Sprouts* (fig. 180), *Brassica oleracea bullata gemmifera*, have long been cultivated near Brussels. There appears to be no information as to the origin of the plant, but, according to the late Dr Van Mons, it is mentioned in the year 1213, in the regulations for holding the markets of Belgium, under the name of *spruyten* (sprouts). It is very hardy and productive, and is much esteemed for the table on account of its mild sweet flavour, and its rightly appearance.

The seed should be sown about the middle of March, and again in the first or second week in April for succession. Any good garden soil is suitable. For an early crop it may be sown in a warm pit in February, pricked out and hardened in frames, and planted out in a warm situation in April. The main crop may be planted in rows 2 feet asunder, the plants 18 inches apart. If they are got out early, so as to be well established, they come into use before winter. The head

may be cut and used after the best of the little rosettes which feather the stem have been gathered; but, if this be cut too early, it exposes these rosettes, which are the most delicate portion of the produce, to injury should the weather be severe.

The earliest sprouts become fit for use in November, and they continue to be produced, improving in quality, till the month of March following. Van Mons mentions that by successive sowings the sprouts are obtained in Brussels for the greater part of the year.



FIG. 180.—Brussels Sprouts; Aigburth or Otterspool.

The most reliable crop is perhaps obtained from imported seed of the ordinary variety ; but good English-raised seed, represented by the Aigburth or Otterspool (fig. 180), a variety of medium growth ; Scrymgeour's Giant, of robust habit ; Carter's Perfection, and others, may be had. We doubt the policy of planting the very dwarf kinds, as the taller ones with longer stems, if vigorous, must yield a larger produce.

In this place may best be noted two hybrid sprouts, both raised by Mr Melville, at Dalmeny Park, near Edinburgh. They are the Albert Sprouts, a hardy green, long in running to seed, the result of a cross between the savoy and Brussels sprouts ; and the Dalmeny Sprouts, which grow 6 inches or 8 inches high, with a compactly cabbaged head of moderate size, and a stem thickly set with cabbage-like sprouts, a cross obtained between the cabbage and Brussels sprouts. Both may be grown in the same way as the borecoles.

The *Cabbage*, *Brassica oleracea capitata*, has sprung from the biennial *B. oleracea* of the British sea-coasts. The cabbage requires a well-manured and well-wrought loamy soil. It should have abundant water in summer, liquid manure being specially beneficial. Round London, where it is grown in perfection, the ground for it is dug to the depth of two spades or spits, the lower portion being brought up to the action of the weather, and rendered available as food for the plants ; while the top-soil, containing the eggs and larvæ of many insects, being deeply buried, the plants are less liable to be attacked by the club. Farm-yard manure is that most suitable for the cabbage, but artificial manures such as guano, superphosphate of lime or gypsum, together with lime-rubbish, wood-ashes, and marl, may, if required, be applied with advantage.

The first sowing of cabbage should be made about the beginning of March, and should consist of Nonpareil or Enfield Market (also known as the Early Battersea) ; these will be ready for use in July and August, following the autumn-sown crops. Another sowing of the same sorts, or of the St John's Day, should be made in the last week of March or first week of April, and will afford a supply from August till November ; and a further crop of such sorts as Early York, Little Pixie, Atkins's Matchless, or other kinds that heart quickly, may be made in May to supply young-hearted cabbages in the early part of winter. The autumn sowing, which is the most important, and affords the supply for spring and early summer use, should be made about the last week in August, in warm localities

in the south, and about a fortnight earlier in the north; or, to meet fluctuations of climate, it is as well in both cases to anticipate this sowing by another two or three weeks earlier, planting out a portion from each, but the larger number from that sowing which promises best to stand without running to seed. The sorts should be Enfield Market, Nonpareil, or Winnigstadt. These later sown plants will be ready for transplanting by the end of September or early in October, and may be placed in the ground previously occupied by the pea or bean crop.



FIG. 181.—Cabbage; St John's Day.

The cabbages grown late in autumn and in the beginning of winter are denominated Coleworts (vulg. Collards), from a kindred vegetable no longer cultivated. Two sowings are made, in the middle of June and in July, and the seedlings are planted a foot or 15 inches asunder, the rows being 8 or 10 inches apart. The sorts employed are the Rosette and the Hardy Green.

About London the large sorts, as Enfield Market, are planted for spring cabbages 2 feet apart each way; but a plant from an earlier sowing is dibbled in between every two in the rows, and an intermediate row a foot apart is put in between the permanent rows, these extra plants being drawn as coleworts



FIG. 182.—Cabbage; Large York.

in the course of the winter. The smaller sorts of cabbage may be planted 12 inches apart, with 12 or 15 inches between the rows. The large sorts should be planted 2 feet apart, with 2½ feet between the rows. The only culture required is to stir the surface with the hoe to destroy the weeds, and to draw up the soil round the stems.

The *Red Cabbage*, *Brassica oleracea capitata rubra*, of which the Red Dutch is the most commonly grown, is much used for pickling. It is sown about the end of July, and again in March or April. The Dwarf Red and Utrecht Red are smaller sorts. The culture is in every respect the same as in the other sorts, but the plants have to stand until they form hard close hearts.

The *Couve Tronchuda* or *Portugal Cabbage*, *Brassica oleracea acephala costata*, is of a distinct type and of excellent quality. The fleshy ribs of the leaves, cooked like sea-kale, are the only parts eaten. It is somewhat tender, and requires to be sown early in spring for use during the autumn.

The names of the varieties of cabbage are very numerous, but on comparing them at Chiswick, Mr Barron reduced the garden varieties to about seventeen types, the best of which are:—*Early sorts*: Atkins's Matchless, Early York, Little Pixie, Nonpareil, St John's Day (fig. 181). *Mid-season*: Large York (fig. 182), Enfield Market (Battersea or Fulham), Rosette Colewort, Winnigstadt. *Late sorts*: Bacalan, Hardy Green Colewort, Pomeranian.

The *Capsicum* is the produce of several species of the genus *Capsicum* cultivated for the sake of their pods, which in a green state are used in salads and in pickles, and when ripe are powdered to form cayenne pepper. The pods, either green or ripe, are also used to make Chili vinegar.

The *Annual Capsicum*, *Spanish Pepper*, or *Guinea Pepper*, *Capsicum annum*, is the sort most commonly grown. The seeds should be sown in a hotbed in February, the young plants being transferred successively into 3-inch, 5-inch, and 8-inch pots. They require a warm genial atmosphere, and a light rich soil, and should be assisted with liquid manure or such artificial fertilizers as Clay's or Jackman's. In the south of England they may be grown in the



FIG. 183.—*Capsicum gros carré doux*.

open air, on a warm sunny border, if planted out towards the end of June. The fruit ripens in September, and may be kept two or three years in a dry room. The *Bird Pepper*, *C. baccatum*, and the *Chili*, *C. frutescens*, are both sub-shrubby plants, requiring stove heat. They should be grown in peaty soil, should not be over-potted, and should be kept dryish at the root in winter. The best cayenne pepper is prepared from *C. frutescens*, and *C. baccatum* is much relished by some persons. The *Bell Pepper*, *C. grossum*, and the *Large Sweet Spanish*, of which the variety called *gros carré doux*, or Large Sweet Square Capsicum (fig. 183), is a form, are milder in flavour, and are much eaten in salads and also with cold meats.

The *Cardoon* (fig. 184), *Cynara Cardunculus*, a perennial from the



FIG. 184.—Cardoon; Tours.

south of Europe and Barbary, is a near relative of the artichoke. The edible part, called the *chard*, is composed of the blanched and crisp stalks of the inner leaves. Cardoons are found to prosper on light deep soils. The seed is sown annually about the middle of May, in shallow trenches, like those for celery, and the plants are thinned out to 10 or 12 inches from each other in the lines. In

Scotland it is preferable to sow the seed singly in small pots, placing them in a mild temperature, and transplanting them into the trenches after they have attained a height of 8 or 10 inches. Water must be copiously supplied in dry weather, both to prevent the formation of flower stalks and to increase the succulence of the leaf-stalks. In autumn these leaf-stalks are applied close to each other, and wrapped round with bands of hay or straw, only the points being left free. Earth is then drawn up around them to the height of 15 or 18 inches. Sometimes cardoons are blanched by a more thorough earthing up, in the manner of celery, but in this case the operation must be carried on from the end of summer. During severe frost the tops of the leaves should be defended with straw or litter. Besides the common and Spanish cardoons, there are the prickly-leaved Tours, the red-stemmed, and the Paris cardoon, all of superior quality, the Paris being the largest and most tender. The common artichoke is also used for the production of chard.

The *Carrot*, *Daucus Carota*, has been much improved and transformed from the wild state; it is probably a native of the sea-

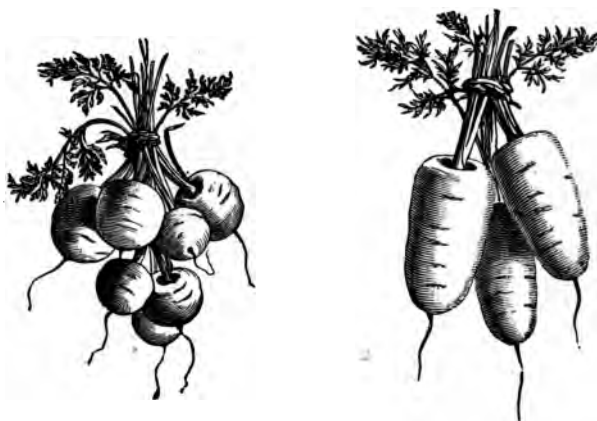


FIG. 185.—Carrot: French forcing.

FIG. 186.—Carrot; Early Short Horn.

coasts of southern Europe, but is now abundant throughout Europe and Asiatic Russia. The carrot delights in a deep sandy soil, which should be well drained and deeply trenched. In regard to the preparation of the ground, one of our best northern gardeners has said—

"Trench in autumn; trench deep and lay the manure at the bottom of the trench; in spring rake down, lay on an inch of wood ashes, and dig them lightly in." For the long-rooted sorts the soil should be at least 3 feet deep, but the Short Horn varieties may be grown in about 6 inches of good compost laid on the top of a less suitable soil. Peat earth may be usefully employed in lightening the soil. Good carrots of the longer sorts may be grown in unfavourable soils by making large holes 18 inches deep with a crowbar, and filling them up with sandy compost in which the seeds are to be sown. The main crop is sown at the end of March or beginning of April. After sowing, it is only necessary to thin the plants, and keep them clear of weeds. The roots are taken up in autumn and stored during winter in a cool shed or cellar.

Forcing.—For a supply of young carrots in winter, a hotbed composed of 3 or 4 feet thick of leaves, or of 18 inches of dung, or of 2 feet of dung and leaves mixed, should be prepared about the end of November or beginning of December, and covered with a frame and lights. The bed should be surfaced with 8 or 9 inches of light soil, of which leaf-mould may form a considerable proportion, and the seed of Early Short Horn, Early Nantes, or French Forcing should



FIG. 187.—Carrot; Long Blunt Red.

be sown in drills 3 inches apart, and covered to the depth of $\frac{1}{2}$ inch. The young plants should be thinned to $1\frac{1}{2}$ inches apart. The temperature should range from 60° to 65° , as much light and air being given as possible, but the sashes should be covered at night, especially in frosty weather. For succession sow again on a gentle hotbed under glass early in February, and follow this by another sowing on a warm sheltered south border early in March. The seed bed should be made up of light rich compost, in a situation well ex-

posed to the sun. If these quick-growing sorts are preferred, small successional sowings should be made in May and again in July, James's Intermediate being substituted at the last sowing. Where a little protection can be given by a frame in winter, some of the Early Short Horn may be sown in August for spring use.

The following are good garden carrots:—*Early*: French Forcing (fig. 185), Early Nantes, Early Short Horn (fig. 186). *Mid-season*: James's Intermediate, Long Blunt Red (fig. 187), with very small core. *Main Crop*: Long Surrey, Altringham.

The *Cauliflower*, *Brassica oleracea botrytis cauliflora*, is said by our old authors to have been introduced from Cyprus, where, as well as on the Mediterranean coasts, it appears to have been cultivated for ages. It is one of the most delicately flavoured of vegetables, the dense cluster formed by its incipient succulent flower-buds being the edible portion.

The sowing for the first or spring crop, to be in use in May and June, should be made from the 15th to the 25th of August for England, and from the 1st to the 15th of August for Scotland. In the neighbourhood of London the growers adhere as nearly as possible to the 21st day. A sowing to produce heads in July and August takes place in February on a slight hotbed. A late spring sowing to produce cauliflowers in September or October or later, should be made early in April, and another about the 20th of May.

The cauliflower succeeds best in a rich soil and sheltered position; but, to protect the young plants in winter, they are sometimes pricked out in a warm situation at the foot of a south wall, and in severe weather covered with hoops and mats. A better method is to plant them thickly under a garden frame, securing them from cold by coverings, and giving air in mild weather. For a very early supply, a few scores of plants may be potted and kept under glass during winter, and planted out in spring, defended with a hand-glass. Sometimes patches of three or four plants on a south border are sheltered by hand-glasses throughout the winter. It is advantageous to prick out the spring-sown plants into some sheltered place, before they are finally transplanted in May. The later crop, the transplanting of which may take place at various times, is treated like early cabbages. After planting, all that is necessary is to hoe the ground, and draw up the soil about the stems.

It is found that cauliflowers ready for use in October may be kept in perfection over winter. For this purpose they are lifted carefully with the spade, keeping a ball of earth attached to the roots. Some

of the large outside leaves are removed, and any points of leaves that immediately overhang the flower are cut off. They are then placed either in pots or in hotbed frames, the plants being arranged close together, but without touching. In mild dry weather the glass frames are drawn off, but they are kept close during rain storms; and in severe frost they are thickly covered with mats.

The late Mr Barnes of Bicton informs us in the *Gardener's Magazine* that his cauliflowers for spring are sown the first week of October, in pans, in a little bottom heat; and about the end of the month, or the beginning of November, are potted singly into 3-inch pots; they are planted in some of the old melon-bed mould, and plunged close to the glass. About the beginning of January they are shifted finally into 7-inch pots. In the first week in February the ground is prepared for them. If wet, a little of the soil is taken out where each hand-glass is to stand, and replaced with dry dusty rubbish, in order to prevent the cauliflowers from getting the disease of "black legs." Four plants are turned out under each hand-glass. If the weather proves dry, a liquid manure, consisting of $\frac{1}{4}$ lb of nitrate of soda to 1 hogshead of cow-dung water, with the addition of a few gallons of hot water, is applied, which causes the plants to grow in March as in May, and produce fine cauliflowers early in April. Mr Barnes states that by shifting on the plants until they are in 12-inch pots, and then placing them in a vinery or peach-house, he has had cauliflowers early in March.

Some of the best varieties of cauliflower are—the Walcheren, which, if true, is of excellent quality, and the most generally useful for autumn; Dwarf Erfurt, which is very dwarf and early, and good for summer and early autumn use; Early London, rather tall, but with a fine compact curd; Le-normand's, a second early; Snowball, dwarf, compact, and quick-heading; and Veitch's Autumn Giant, which is an excellent hardy sort for autumn.

The *Celeriac*, *Apium graveolens rapaceum*, the *cèleri-navet* of the French, is a variety of celery in which the stem forms an irregular knob, which is the part used, either sliced in salads or cooked. It is a hardy substitute for other kinds of celery. The roots grow to 3 lb or 4 lb weight. The plants should be reared like those of celery; and, some time before winter sets in, they should be taken up and stored amongst sand in a shed or cellar.

The *Celery*, *Apium graveolens*, has been so much improved by cultivation as to have lost its acrid deleterious properties, and is now a stout succulent plant, with a mild and agreeable flavour, and in

the finer varieties with the stalks solid instead of hollow and pipy. The blanched portions only should, however, be used.

Celery is usually sown at three different times,—on a hotbed in the beginning of March, and in the open ground in March, and again in April. The seedlings, when about 2 inches high, are pricked into rich soil, in which they are allowed to stand till they are 4 or 5 inches high. The first crop is defended by frames or hand-glasses, and is planted wide to admit of being lifted with balls of earth adhering to the roots. Towards the end of May trenches for blanching the celery are prepared $3\frac{1}{2}$ or 4 feet apart, 15 inches wide at the bottom, and about a foot below the natural level of the surface. The soil at the bottom of the trench is to be carefully dug and manured, and a single row of plants placed in each trench. Sometimes, where a large supply is required, the trenches are made 6 feet wide, and rows 15 or 18 inches apart are planted across the trenches. As the plants advance in growth, earth is laid up about the stalks of the leaves, and this is repeated at the end of every ten or fifteen days. Many delay the earthing-up until the plants have nearly attained their full size, when the operation is performed at once; but it is better to commence earthing-up when the crop is about half-grown, and to complete it by adding a little more soil at short intervals. Successional crops should be planted out from the 1st of June till the 1st of August. Celery loves a rich light soil, and will bear to be flooded with water at the root while growing.

The varieties of celery include some with red stalks and some with white. The latter, as they blanch more perfectly than the red, are sometimes preferred, but the red varieties blanch to a very delicate pink, and are generally better flavoured. Some of the best varieties are:—*Whites*: Early Dwarf Solid White (Incomparable White), Williams's Matchless White, Wright's Grove White. *Reds*: Leicester Red (Major Clarke's Solid), Ivory's Nonesuch, Sulham Prize Pink, Williams's Matchless Red.

The *Chicory* or *Succory*, *Cichorium Intybus*, is much esteemed by the French as a winter salad, and when blanched is known by the name of *Barbe de Capucin*. When intended for winter use, it is sown in May or June, commonly in drills, and the plants are thinned out to 4 inches apart. If at first the leaves grow very strong, they are cut off, perhaps in the middle of August, about an inch from the ground, so as to promote the production of new leaves, and check the formation of flower-stems. About the beginning of October the plants are raised from the border, and all the large leaves cut off; the roots are also shortened, and they are then planted

pretty closely together in boxes filled with rich light mould, and watered when needful. When frost comes on, the boxes are protected by any kind of litter or haulm. As the salad is wanted, they are removed into some dark place having a moderately increased temperature. Each box affords two crops of blanched leaves, and these are reckoned fit for cutting when about 6 inches long.

Another mode of obtaining the young leaves of this plant in winter is to sow seeds in a bed of light rich mould, or in boxes in a heat of from 55° to 60°, giving a gentle watering as required. The leaves will be fit to cut in a fortnight after sowing, and the plants will afford a second crop.

In Belgium a variety of chicory called *Witloef* (fig. 188) is much preferred as a salad to the French *Barbe de Capucin*. The seeds are sown and the plants thinned out like those of the ordinary sort. They are eventually planted in light soil, in succession, from the end of October to February, at the bottom of trenches a foot or more in depth, and covered over with from 2 to 3 feet of hot stable manure. In a month or six weeks, according to the heat applied, the heads are fit for use, and should be cut before they reach the manure. The plants might easily be forced in frames on a mild hotbed, or in a mushroom-house, in the same way as sea-kale.

The sorts cultivated are the Common, the Improved, and the Witloef. That grown for mixing with coffee is a variety with larger fleshy roots.



FIG. 188.—Witloef.

The *Chives*, *Allium Schœnoprasum*, is a hardy perennial, found in the North of England and in Cornwall, and growing in rocky pastures throughout temperate and northern Europe and Asiatic Russia, and also in the mountain districts of southern Europe. It is cultivated for the sake of its leaves, which are used in salads and soups as a substitute for young onions. It will grow in any good

soil, and is propagated by dividing the roots into small clumps in spring or autumn; these are planted from 8 to 12 inches apart, and soon form large tufts. The leaves should be cut frequently so as to obtain them tender and succulent.

The *Corn-Salad* or *Lamb's Lettuce*, *Valerianella olitoria*, is a weedy annual, native of southern Europe, not unfrequent in Britain. In France it is used during winter and spring as a substitute for lettuces, but is less esteemed in England. The plant is raised from seed sown on a border of light rich earth, and should be weeded and watered, as occasion requires, till winter, when it should be protected with long litter during severe frost. The largest plants should be drawn for use in succession. Sowing may be made every two or three weeks from the beginning of August till October, and in March, if required in the latter part of the spring. The principal sorts are the Round-leaved and the Italian.

The *Cress*, or *Garden Cress*, *Lepidium sativum*, is an annual plant, native of western Central Asia. It is used in salads, the young plants being cut and eaten while still in the seed-leaf, forming, along with plants of the white mustard in the same stage of growth, what is commonly called "small salad." The seeds should be sown thickly broadcast or in rows in succession every ten or fourteen days, according to the demand. The sowings may be made in the open ground from March till October, the earliest under hand-glasses, and the summer ones in a cool moist situation; but during winter they must be raised on a slight hotbed, or in shallow boxes or pans placed in any of the glass-houses where there is a temperature of 60° or 65°.

The *Golden* or *Australian Cress* is a dwarf, yellowish green, mild-flavoured sort, which is cut and eaten when a little more advanced in growth, but while still young and tender. It should be sown at intervals of a month from March onwards, the autumn sowing, for winter and spring use, being made in a sheltered situation.

The *Curled* or *Normandy Cress* is a very hardy sort, of good flavour. In this, which is allowed to grow like parsley, the leaves are picked for use while young; and, being finely cut and curled, they are well adapted for garnishing. It should be sown thinly in drills, in good soil in the open borders, in March, April, and May, and for winter and spring use at the foot of a south wall early in September, and about the middle of October.

The *Cucumber*, *Cucumis sativa*, a tender annual, is cultivated both for stewing and pickling, but more generally and extensively for salads. Being an annual plant, it is usually increased by seeds, but it may be readily raised from cuttings, which should consist of the tops of the leading branches, and should be planted in deep pots, half-filled with a compost of leaf-mould and sand, the pots being then covered with a pane of glass, and plunged in a brisk heat. To grow this plant successfully through the winter, a tropical heat must be maintained. If properly heated hot-water pits or houses cannot be had, and hotbeds have to be employed, it is better not to attempt very early forcing, but to defer sowing till about the first week in February.

In hotbed culture, the preparation of materials for the seed-bed which should consist of stable dung in a full state of fermentation, should be set about towards the middle of January. The dung should be turned over, well shaken, and mixed about three times at intervals of a few days. The bed should be made up in a sheltered situation open to the sun. The frame should then be set on, and the sashes kept closed till the heat rises to 85° or so, when they should be tilted to allow the steam to pass off. In a few days the surface of the bed should be covered with a layer a few inches in thickness of light soil; as soon as the heat of the bed declines to about 70° the seeds may be sown singly in 3-inch pots of sifted leaf-mould, with a lump of fibrous turf at the bottom for drainage, the seed being moderately pressed into the soil, and covered to the depth of about half an inch. The bottom heat should range from 75° to 80°. After germination, the plants should be placed within 6 inches of the glass. When the plants have formed two joints, the growing point should be stopped above the second joint, the succeeding young shoots being stopped above the second or third joint. Subsequently three or four of the shoots, as nearly equal in strength as possible, should be selected for principal branches, and the laterals from these should be allowed to fill out the frame and bear fruit; they should be stopped at one or two joints above the fruit, and all weak shoots removed, being pinched off with the finger and thumb rather than cut, to avoid loss of sap by bleeding. The cucumber is a monœcious plant, and at one time, in order to secure the swelling of the fruit, the female flowers were carefully fertilized; but it is found that this is not necessary unless seed is required.

The fruiting-bed is to be made up in the same way as the seed-

bed, only, as it is required to be more lasting, it is better to mix up tree leaves with the dung. The bed may be made up in the first week in February, and should be 4 feet high in front, and $4\frac{1}{2}$ feet at back. The frame should be put on at once, and the lights or sashes kept closed till the heat has risen to the surface. If dry the dung may require watering to keep up fermentation; if it is moist and hot it may be found necessary to make holes with a stake in the sides of the bed to moderate the heat; but unless it rises above 85° there is no danger of its injuring the roots. A few days before the plants are introduced some hillocks of soil should be put into the frame, in order that they may become thoroughly warmed. These should be so arranged that the plant is within 6 inches of the glass. The plants themselves should be removed to the frame for a day or two before turning them out, the soil being moist, but not wet. A good medium compost may consist of two parts of turfy loam, one of peat, and one of leaf-mould, with the addition of some clean coarse sand; or of two parts turfy friable loam, two of turfy heath-mould, three of leaf-mould, and one of clean coarse sand. If the loam be of a less fibrous nature, more peat or leaf-mould or some decayed dung should be used. The bottom heat should range from 75° to 80° , and the atmosphere should be kept moist, and at a temperature ranging from 70° to 80° , the latter by sun-heat. An abundance of light is also essential, but in very bright sunshine a thin shading is beneficial. The water used both at the roots and at the tops should always be warmed, and, while ventilation is to be duly attended to, a cold draught should be avoided.

Winter cucumbers are generally grown in small houses set apart for them (figs. 14, 15). The seeds are sown in August, and planted out so as to become well established before the dull weather sets in. In the case of culture in houses or pits, the heat, bottom and top, is maintained by hot-water pipes or tanks, and the branches are trained over trellises placed about a foot from the glass. The plants must in this case be run up with a single stem, till they reach the upper side of the trellis, when the leader should be stopped in order to produce the branches necessary for covering the allotted space, and these must also be stopped when fruit-bearing laterals are required. These last should be stopped at one joint beyond the fruit, till it can be seen whether or not a shoot will push from the same joint as the fruit, in which case the joint above the fruit is also to be pinched off.

The hardier varieties of cucumber, especially the short prickly sorts, known as *gherkins*, and used for pickling, are often grown under hand-glasses, a cavity having been made in a warm situation, and filled with hot dung and a small covering of earth. In the southern counties of England, pickling cucumbers are sown in drills in the open ground. The earth is made fine and level, and at distances of $3\frac{1}{2}$ feet, in rows 6 feet apart, shallow circular hollows are formed with the hand, a foot wide, and half an inch deep in the middle, in each of which, about the beginning of June, eight or ten seeds are deposited. When the plants appear, they are thinned out to three or four, the weakest or least healthy being rejected, and all the further attention they require is occasional cleaning and watering, according to the state of the weather.

Some of the most popular varieties of the cucumber are :—

Spineless : Rollisson's Telegraph, Carter's Champion, Syon House Improved. *White-spined* : Kenyon's Improved, Empress Eugenie, Improved Manchester Prize, Latter's Victory of England, Henderson's Champion.

Black-tipped White-spined : Tender and True, Hamilton's Market Favourite, Blue Gown.

Black-spined : Dr Livingstone, Henderson's Al, Weedon's Black Spine.

The *Egg Plant*, *Solanum Melongena*, the *Aubergine* or *Brinjal* of the French, is a tender annual, native of South America and of the tropical parts of Asia and Africa. In France it is cultivated for the fruits, which are cooked before they are eaten. The seed should be sown early in February in a warm pit, where the plants are grown till shifted into 8-inch or 10-inch pots, in well-manured soil. Manure water should be given occasionally while



FIG. 189.—Egg Plant ; Large Purple.

the fruit is swelling, about four fruits being sufficient for a plant. The French growers sow them in a brisk heat in December, or early in January, and in March plant them out four or eight in a hot-bed with a bottom heat of from 60° to 68°, the sashes being gradually more widely opened as the season advances, until they may be taken off by about the end of May. The two main branches which are allowed are pinched to induce laterals, but when the fruits are set all young shoots are taken off in order to increase their size. The best variety is the Large Purple (fig. 189), which produces oblong fruit, sometimes reaching 6 or 7 inches in length, and 10 or 12 inches in circumference. The Chinese is also an oblong-fruited sort, with white fruit and more juicy flesh than some of the other sorts. The fruit of the ordinary form almost exactly resembles the egg of the domestic fowl.

The *Endive*, *Cichorium Endivia*, is a hardy annual, native of the northern provinces of China and other parts of Asia. As in the case of the lettuce, the blanched hearts are used for salads and in soups. The main crop should be sown about the middle of June, on a seed-bed of light rich soil, and the early crop about the middle of May. The seeds should be scattered sparsely, that the plants may not come up in clusters. The seedlings should be transplanted into a rich soil in an open situation, at about a foot apart in rows, which for the curled-leaved sorts should be a foot asunder, and for the broad-leaved sorts 15 inches. When the plants have reached their maturity, the leaves are gathered up and tied together a little below the tips, and a few days later about the middle of the plant, and in two or three weeks they are found sufficiently blanched for use.

For winter use the seed should be sown about the middle of July, and a little additional in August. They should be planted in the same way as the earlier crops, but it is advisable, as they approach maturity, to draw the earth quite up about the leaves. At that season, too, the plants may be advantageously planted on sloping banks of earth facing south. They may be blanched by inverting a garden pot with the drainage hole closed, or a common garden saucer 10 or 12 inches in diameter, over the centre of the plants as they grow flat on the earth. Later on they may be blanched in boxes in the mushroom-house, or in a cellar, or by using blanching pots. The time occupied in blanching varies from ten days in summer to three weeks in winter. A sufficient quantity to afford a supply for a week may be operated on at one time.

For protection during the winter it is a good plan to plant the endive on November, at 6 or 8 inches apart, on sloping sheltered banks facing the south, covering it with litter in severe weather, but leaving it uncovered at all other times. A more certain method to obtain a supply during that season is, however, either to take up the late-sown plants before frost sets in, and to plant



FIG. 190.—Curled Endive; Meaux.

them in dry earth or sand in a frame, or to place a frame over them where they grow. The early winter crops are sometimes planted at the back of a south wall, and when covered up for blanching they will endure a considerable amount of cold.



FIG. 191.—Batavian Endive; Round-leaved.

There are two races of endives, the Curled (*Chicorée frisée* of the French), with crispy much-cut leaves, and the Batavian (*Scarole* of the French), with broad lettuce-like leaves. Some of the favourite sorts

Curled: French Small Green Curled, early; Large Green Curled Meaux (fig. 190); Curled Picpus; and Stag's Horn, hardy, suitable for late crops.

Batavian: Small Batavian, Round-leaved Batavian (fig. 191); Lettuce-leaved, early; and Fraser's Broad-leaved Batavian, for late crops.

The *Garlic*, *Allium sativum*, a hardy bulbous perennial, is propagated by separating the cloves of which the bulbs are composed, and planting them 2 to 3 inches deep in spring, at a few inches apart, in rows a foot asunder, in a light, rich, and rather dry soil, and in a warm situation. A few short rows will suffice in most cases. After the leaves have ripened, the bulbs may be taken up, sundried, tied in bunches by the stalks, and hung up in a dry airy cool store-room till wanted. Garlic is used for flavouring.

The *Gourds* cultivated in gardens for their esculent produce are varieties of several species of *Cucurbita*, the most commonly used being the vegetable marrow and the pumpkin.

The *Vegetable Marrow* (fig. 192), *Cucurbita Pepo* var., is the most important of the gourds used as an esculent, and furnishes in good seasons a very large supply for the table. The fruits are best when eaten quite young and not over-boiled, the flesh being then tender, and the flavour remarkably sweet and nutty.

Vegetable marrows require a warm situation and a rich soil free from stagnant moisture. They do well on a rubbish or old-dung heap, or in a warm border on little hillocks made up with any fermenting material, to give them a slight warmth at starting. The earliest seeds should be sown in a warm pit in April, and forwarded under glass, in a very mild heat; the plants must be shifted into larger pots, and gradually hardened previous to being planted out, when mild weather sets in in May or June. The use of hand-glasses makes it possible to transplant earlier than would otherwise be advisable. Other seeds may be sown early in May in pots under a hand-glass, or towards the end of May in the open ground, if heat is not at command. The shoots may be allowed to run along the surface of the ground, or they may be trained against a wall or paling, or on trellises. The true vegetable marrow or succade gourd bears fruit of an oblong-elliptical shape, about 9 inches long, pale-greenish while young, with whitish flesh, and scarcely any indication of ribs; when mature it is of a pale yellow colour. One of the best vegetable marrows is called *Moore's Vegetable Cream*. There is a variety which is more elongate (fig. 193), grows to 15 or



FIG. 192.—Vegetable Marrow.

18 inches, and has the surface slightly marked by irregular longitudinal obtuse ribs. As the gourds cross readily, care is necessary to keep any particular variety true.



FIG. 193.—Vegetable Marrow; Long White.

The *Custard Marrow*, one of the *Patissons* or *Crown Gourds*, bears a peculiar-looking flattened fruit with scalloped edges, which has a sweeter and less nutty flavour than the true marrow.

The *Pumpkin*, *Cucurbita maxima*, grows to a very large size, some of the varieties, as the large yellow or *Potiron jaune*, sometimes producing fruit over 200 lb in weight. The flesh of this is yellow, the ripe fruit, in which state only it is used, being of a pale salmony buff colour exteriorly. It will keep for some months in a dry airy place, and is used in soups or stews, or mashed like potatoes, or baked in pies. There are several varieties of this type. The cultivation of the pumpkin resembles that of the vegetable marrow, but it requires abundance of space for its spreading vines.

Many of the other gourds (of which some are very ornamental) produce edible fruits, but as some, notably the orange gourd and the bottle gourd, are cathartic and deleterious, they should not be indiscriminately eaten.

The *Horseradish*, *Cochlearia Armoracia*, or *Armoracia rusticana*, a hardy perennial, is cultivated for its long roots, or more properly underground rootstocks, which when scraped into shreds, or grated and made into a delicious sauce, are eaten with roast beef. Its properties are antiscorbutic. The horseradish requires a deep, rich, and rather moist sandy loam or alluvial soil, the object being to obtain long straight roots. One method of producing new plants is to plant the sets, consisting of the crowns of old roots, or of 1 or 2 inch lengths of the root itself, at the bottom of a trench $2\frac{1}{2}$ feet deep, the lower half of the soil being well manured; only a single shoot should be retained, so as to produce one thick vigorous stick. The roots planted in spring are sometimes taken up in the winter following. In digging the roots the soil should be thrown back so as to lay them bare. Those that spring from the set are cut off, and it is manured and left to grow up again the following year. Before the ground becomes frost-bound, a supply should be dug up, and stored in damp sand for use during that emergency.

The *Jerusalem Artichoke*, *Helianthus tuberosus*, a hardy tuberous perennial, a species of sunflower, derives its epithet *Jerusalem* from a corruption of the Italian *Girasole*, a sunflower, and its name of *Artichoke* from the resemblance in flavour which its tubers bear to that of the receptacles or "bottoms" of that plant. It is propagated by means of its tubers planted in the manner of potatoes, in rows 3 or 4 feet asunder, some time in February or March; by the autumn the new tubers will be fit for use. As a matter of convenience, though the tubers themselves are hardy enough to bear the frosts of winter, they may be dug up about November, and stored in dryish sand. They should have a well-manured soil, and the stems should not be allowed to be too crowded, which is in great measure obviated by planting them annually.

The *Kidney Bean* includes what is commonly known as the French Bean, *Phaseolus vulgaris*, and the Scarlet Runner, *Phaseolus multiflorus*, both very productive vegetables of excellent quality.

The *Common Kidney Bean* or *French Bean*, *Phaseolus vulgaris*, is a tender annual, and should be grown in a rich light loamy soil and a warm sheltered situation. The soil should be well enriched with hotbed dung. The earliest crop may be sown by the end of March or beginning of April. If, however, the temperature of the soil is below 45° , the beans make but little progress. The main crops should be got in early in May; and a late

sowing may be made early in July. The earlier plantings may be sown in small pots, and put in frames or houses, until they can be safely planted out-of-doors. The earliest out-of-doors crop may be sheltered by means of thatched hurdles, placed sloping on bearers supported by posts. The seeds should be covered $1\frac{1}{2}$ or 2 inches deep, the distance between the rows being about 2 feet, or for the dwarfest sorts 18 inches, and that between plants from 4 to 6 inches. The pods may be used as a green vegetable, in which case they should be gathered whilst they are so crisp as to be readily snapped in two when bent; but when the dry seeds are to be used, the pods should be allowed to ripen. As the green pods are gathered others will continue to be formed in abundance; but if old seed-forming pods are allowed to remain, the formation of young ones will be greatly checked.

Forcing.—The kidney bean may be easily forwarded in pots in a forcing-house, or in prepared soil in a heated pit. The bottom heat should range about 70° , and the atmospheric temperature should show a minimum of 60° , and a maximum of 70° , running up to 80° by sun-heat. The seed should be sown three or four in a 10-inch pot, nearly filled with light turfy soil and leaf-mould, or decomposed cow dung, the stems being earthed up after the true leaves are formed; and they must be well syringed and watered daily. To keep down the red spider, the under side of the leaves should be thoroughly moistened by syringing early in the morning with water at 60° ; the house being then kept shut up till the air is raised to 75° or 80° , both surfaces will, in consequence of condensation, become thoroughly wetted. When the plants come into flower, plenty of air must be admitted. Kidney beans may thus be obtained fit for use, in six weeks or two months from the time of sowing. It may therefore be desirable to sow some seed in August to succeed the crops in the open ground, and, for succession, in September and October; for spring use sow in January, February, and March. The early dwarf sorts are the best for forcing, such as Fulmer's Early, Newington Wonder, Osborn's Forcing, Williams's Early Prolific, Syon House, and White Advancer.

The varieties of French beans being numerous, we here add the names of some of the most desirable for general cultivation:—

Early: White Canterbury, Fulmer's Forcing, Minier's First Early, Osborn's Forcing, Sir Joseph Paxton, White Advancer.

Second Early: Canadian Wonder, bears late; Negro Long-podded, bears late; New Mammoth Negro, earlier than Canadian Wonder; Newington Wonder; Pale Dun; Syon House; Williams's Prolific, bears late.

The *Scarlet Runner Bean*, *Phaseolus multiflorus*, differs from the common French bean in being a perennial, and in having tuberous roots, which, it may be stated, are narcotic and poisonous. These may be preserved through the winter in dryish earth in a frost-proof cellar, for an early crop the following season. The late Mr Cuthill mentions having found from experiment that plants raised from roots come into bearing just one month earlier than those raised from seed. The seeds of the runner beans should be sown in an open plot,—the first sowing in May, another at the beginning of June, and a third about the middle of June. In the London market-gardens they are sown 8 to 12 inches apart, in 4 feet rows if the soil is good. The twining tops are pinched or cut off when the plants are from 2 to 2½ feet high, to save the expense of staking. It is better, however, in private gardens to have the rows standing separately, and to support the plants by stakes 6 or 7 feet high and about a foot apart, the tops of the stakes being crossed about one-third down. If the weather is dry when the pods are forming abundantly, plenty of tepid water should be supplied to the plants. In training the shoots to their supports, they should be twined from right to left, contrary to the course of the sun, or they will not lay hold.

The ordinary *Scarlet Runner* is most commonly grown, but there is a white-flowered variety which has also white seeds, which is very prolific and of excellent quality, and is now much grown for market. Another variety called *Painted Lady*, with the flowers red and white, is very ornamental, but not so productive. *Carter's Champion* is a large-podded productive variety.

The *Kohl Rabi*, or *Turnip Cabbage*, *Brassica oleracea caulorapa*, is a biennial, the upper part of whose stem swells into a round fleshy mass, resembling a turnip, but produced above ground. *Kohl Rabi* is exceedingly hardy, withstanding both severe frosts and drought. It is not much grown in English gardens, though when used young it forms a good substitute for turnips. The seeds should be sown in May and June, and the seedlings should be planted shallowly in well-manured ground, 8 or 10 inches apart, in rows 15 inches asunder; and they should be well watered, so as to induce quick growth. The bulbs will be fit for use when they are as large as—not larger than—an early turnip. The best sorts are *Early White Vienna*, and *Early Purple Vienna*.

The *Leek*, *Allium Porrum*, a hardy biennial, is said to be a native of Switzerland, but more probably comes from the East.

The leeks, which prefer a light soil, are sown in beds about the middle of March, and later for a succession, and in June or July are planted out 6 inches asunder ; and in rows 15 or 18 inches apart. When the weather is moist the plants are dropped upright into the hole made by the dibble, and no more earth than will just cover the fibres is allowed to fall in, the hole being left open to encourage the stem to swell, and blanching is effected gradually by the earth washing into the hole. They are also planted in trenches like celery, and earthed up when they have made their growth. They will be fit for use in September, and will last till the spring.



FIG. 194.—Leek; Large Rouen.

The best sorts are—Early Netherlands, for early use; Large Rouen (fig. 194), one of the very best; London Flag, and Musselburgh, the latter being reputedly the hardiest; and Carentan, a very large hardy French sort.

The *Lettuce*, *Lactuca sativa*, is a hardy annual, highly esteemed as a salad plant, while its milky juice forms the *lactucarium* of the materia medica. The London market-gardeners make preparation for the first main crop of Cos lettuces in the open ground early in August, a frame being set on a shallow hotbed, and, the

stimulus of heat not being required, this is allowed to subside till the first week in October, when the soil, consisting of leaf-mould mixed with a little sand, is put on 6 or 7 inches thick, so that the surface is within $4\frac{1}{2}$ inches of the sashes. The best time for sowing is about the 11th of October. When the seeds begin to germinate the sashes are drawn quite off in favourable weather during the day, and put on, but tilted, at night in wet weather. Very little watering is required, and the aim should be to keep the plants gently moving till the days begin to lengthen. In January a more active growth is encouraged, and in mild winters a considerable extent of the planting out is done, but in private gardens the preferable time would be February. The ground should be light and rich, and well manured below, and the plants put out at 1 foot apart each way. In planting at this early season, the dibble, in closing in the soil, should be inserted on the south side of the plant. Frequent



FIG. 195.—Cos Lettuce; Paris White.



FIG. 196.—Cos Lettuce; Hicks' Hardy White.

stirring of the ground with the hoe greatly encourages the growth of the plants. A second sowing should be made about the 5th of November, and a third in frames about the end of January or beginning of February. In March a sowing may be made in some warm situation; successional sowings may be made in the open border till August, about the middle of which month a crop of Brown Cos and Hardy Hammersmith should be sown, the latter being the most reliable in a severe winter. These plants may be put out early in October on the sides of ridges



FIG. 197.—Cabbage Lettuce; Neapolitan.

facing the south or at the front of a south wall, beyond the reach of drops from the copings, the Hardy Hammersmith being planted 6 or 8 inches apart. Young lettuce plants should be thinned before they crowd or draw each other, and transplanted as soon as possible after two or three leaves are formed. Some cultivators prefer that the summer crops should not be transplanted, but sown where they are to stand, the plants being merely thinned out; but transplanting checks the running to seed, and makes the most of the ground.

Forcing.—For a winter supply by gentle forcing, the Hardy Hammersmith and Brown Dutch Cabbage lettuces, and the Brown Cos and Green Paris Cos lettuces, should be sown about the middle of August and in the beginning of September, in rich light soil, the plants being pricked out 3 inches apart in a prepared bed, as soon as the first two leaves are fully formed.



FIG. 198.—Lettuce; Gotte.

About the middle of October the plants should be taken up carefully with balls attached to the roots, and should be placed in a mild hotbed of well-prepared dung (about 55°) covered about 1 foot deep with a compost of sandy peat, leaf-mould, and a little well-decomposed manure. The Cos and Brown Dutch varieties should be planted about 9 inches apart. They must have plenty of air when the weather permits, and be protected from frost.

There are two races of the lettuce, the Cos lettuce, with erect oblong heads, and the Cabbage lettuce, with round or spreading heads,—the former generally crisp, the latter soft and flabby in texture. Some of the best lettuces for general purposes of the two classes are the following :—

Cos: White Paris Cos, best for summer (fig. 195); Green Paris Cos, hardier than the white; Alphonse Cos, stands well; Brown Cos, one of the hardest and best for winter; Hicks's Hardy White Cos (fig. 196); Sugarloaf Bath Cos.

Cabbage: Hammersmith Hardy Green, very hardy, good for winter; Tom Thumb; Brown Dutch; Neapolitan, best for summer (fig. 197); Grand Admiral, stands the winter well; Stanstead Park.

The Gotte (fig. 198), a small early French cabbage lettuce, represented in this country by such sorts as the Tennis-ball and Tom Thumb, is very hardy and much grown around Paris for the earliest crops under cloches or bell-glasses.

The *Mushroom*, *Agaricus campestris*, is a well-known fungus of a specially savoury character; it grows wild in Great Britain on upland pastures, and appears to be indigenous to most regions of the globe. The plant is propagated by spores, the fine black dust seen to be thrown off when a mature specimen is laid on white paper or a white dish; these give rise to what is known as the "spawn" or mycelium, which consists of whitish threads permeating dried dung or similar substances, and which, when planted in a proper medium, runs through the mass, and eventually appears in the form of the mushroom. This spawn may be obtained from old pastures, or decayed mushroom beds, and is purchased from nurserymen in the form of bricks charged with the mycelium, and technically known as mushroom spawn. When once obtained, it may, like leaven, be indefinitely preserved. It may be produced by placing quantities of horse dung saturated with the urine of horses, especially of stud horses, with alternate layers of rich earth, and covering the whole with straw, to exclude rain and air; the spawn commonly appears in the heap in about two months afterwards. The droppings of stall-fed horses, or of such as have been kept on dry food, should be made use of.

The method of growing mushrooms in ridges out of doors in summer, or on prepared beds, flat or sloping, in sheds or cellars, at other seasons, may generally be adopted with success. The beds are formed of horse droppings which have been slightly fermented and frequently turned, and the ridge may be 2 or 3 feet broad, and of any length. A layer of dung 8 or 10 inches thick is first deposited, and covered with light dryish earth to the depth of 2 inches; and two similar layers with similar coverings are added, the whole

being made narrower as it advances in height. When the bed is finished, it is covered with straw to protect it from rain, and also from being parched. In about ten days, when the mass is milkwarm, the bed will be ready for spawning, which consists of inserting small pieces of spawn bricks into the sloping sides of the bed, about 6 inches asunder. A layer of fine earth is then placed over the whole, and well beaten down, and the surface is covered with a thick coat of straw. When the weather is temperate, mushrooms will appear in about a month after the bed has been made, but at other times a much longer period may elapse. The principal things to be attended to are to preserve a moderate state of moisture and a proper mild degree of warmth; and the treatment must vary according to the season. The flat beds are made a foot or more in thickness, without the intervening layers of earth.

Mr Cuthill describes a very simple mode of culture. The ridge is built up of dung as it is brought fresh from the London stables; in this fermentation soon sets in, and, when the heat of the bed declines to 80°, pieces of spawn bricks are inserted, a foot apart, in the sides of the bed, which is then moulded over, 2 inches thick, pressed with the feet, and beaten with the spade, then watered, and beaten again with the spade, and finally smoothed down. The more the mould is pressed, the finer the crop.

These ordinary ridge beds furnish a good supply towards the end of summer, and in autumn. To command a regular supply, however, at all seasons, the use of a mushroom-house (see par. 13, p. 226) will be found very convenient. The material employed in all cases is the droppings of horses, which should be collected fresh, and spread out in thin layers in a dry place, a portion of the short litter being retained well moistened by horse urine. It should then be thrown together in ridges and frequently turned, so as to be kept in an incipient state of fermentation, a little dryish friable loam being mixed with it to retain the ammonia given off by the dung. With this or a mixture of horse-dung, loam, old mushroom-bed dung, and half-decayed leaves, the beds are built up in successive layers of about 3 inches thick, each layer being beaten firm, until the bed is 9 or 10 inches thick. If the heat exceeds 80°, holes should be made to moderate the fermentation. The beds are to be spawned when the heat moderates, and the surface is then covered with a sprinkling of warmed loam, which after a few days is made up to a thickness of 2 inches, and well beaten down. The beds made partly of old mushroom-bed dung often contain sufficient

spawn to yield a crop, without the introduction of brick or cake spawn, but it is advisable to spawn them in the regular way. The spawn should be introduced an inch or two below the surface when the heat has declined to about 75°, indeed the heat ought never to exceed 80°. The surface is to be afterwards covered with hay or litter. The atmospheric temperature should range from 60° to 65° till the mushrooms appear, when it may drop a few degrees, but not lower than 55°. If the beds require watering, water of about 80° should be used, and it is preferable to moisten the covering of litter rather than the surface of the beds themselves. It is also beneficial, especially in the case of partially exhausted beds, to water with a dilute solution of nitre. For a winter supply the beds should be made towards the end of August, and the end of October.

The *Mustard*, *Sinapis alba*, or *Brassica alba*, is a hardy annual, used as a small salad—generally accompanied by garden cress—while still in the seed-leaf. To keep up a supply, the seed should be sown every week or ten days. The sowings in the open ground may be made from March till October, earlier or later according to the season. The ground should be light and rich, and the situation warm and sheltered. Sow thickly in rows 6 inches apart, and slightly cover the seed, pressing the surface smooth with the back of the spade. When gathering the crop, cut the young plants off even with the ground. From October to March the seeds should be sown thickly in shallow boxes and placed in a warm house or frame, with a temperature not below 65°.

The *Nasturtium*, or *Indian Cress*, *Tropæolum majus*, is a perennial climber, native of Peru, but in cultivation treated as a hardy annual. The flowers are sometimes eaten in salads, and are used for garnishing, and the leaves and young green fruits are pickled in vinegar as a substitute for capers. The plant should have a warm situation, and the soil should be light and well enriched; sow thinly early in April, either near a fence or wall, which may be utilized for its support, or in an open spot, where it will require stakes 6 to 8 feet high. Its flowers are no less ornamental than useful.

The *New Zealand Spinach*, *Tetragonia expansa*, is a half-hardy annual, native of New Zealand, sometimes used as a substitute for spinach during the summer months, but in every way inferior to it. The seeds should be sown in March, on a gentle hotbed, having been previously steeped in water for several hours.

The seedlings should be potted, and placed under a frame till the end of May, and should then be planted out, in light rich soil. The young leaves are those which are gathered for use.

The *Onion*, *Allium Cepa*, is a hardy bulbous biennial, which has been cultivated in Britain from time immemorial, but the native country of which is unknown. The onion should be grown in an open situation, and on a light, rich, well-worked soil, which has not been recently manured. The principal crop may be sown at any time from the middle of February to the middle of March, if the weather is fine and the ground sufficiently dry. The seed should be sown in shallow drills, 10 inches apart, the ground being made as level and firm as possible, and the plants should be regularly thinned, hoed, and kept free from weeds. At the final thinning they should be set from 3 to 6 inches apart, the latter distance in very rich soil. About the beginning of September the crop is ripe, which is known by the withering of the leaves; the bulbs are then to be pulled, and exposed on the ground till well dried, and they are then to be put away in a store-room or loft, where they may be perfectly secured from frost and damp.

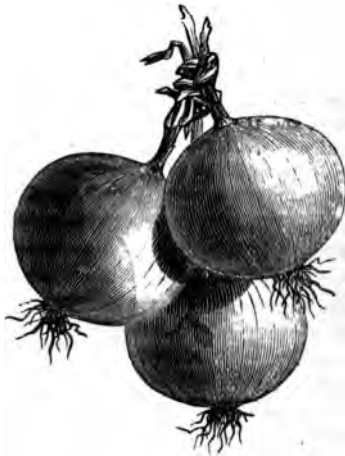


FIG. 199.—Onion; Yellow Danvers.

About the end of August a crop is sown to afford a supply of young onions in the spring months. Those which are not required for the kitchen, if allowed to stand, and if the flower-bud is picked out on its first appearance, and the earth stirred about them, frequently produce bulbs equal in size and quality to the large ones that are imported from the Continent. A crop of very large bulbs may also be secured by sowing about the beginning of September, and transplanting early in spring to very rich soil. Another plan is to sow in May on dry poor soil, when a crop of small bulbs will be

produced ; these are to be stored in the usual way, and planted in rich soil about February, on ground made firm by treading, in rows about a foot apart, the bulbs being set near the surface, and about 6 inches asunder. The White Spanish and Tripoli are good sorts for this purpose.

To obtain a crop of bulbs for pickling, seed should be sown thickly in March, in rather poor soil, the seeds being very thinly covered, and the surface well rolled ; these are not to be thinned, but should be pulled and harvested when ripe. The best sorts for this crop are the Silver-skinned, Early Silver-skinned, White No-cera, and the Queen.

Forcing. — Onions may be forced like mustard and cress if required for winter salads, the seeds being sown thickly in boxes which are to be placed in a warm house or frame. The young onions are of course pulled while quite small.

The *Potato Onion*, *Allium Cepa aggregatum*, is propagated by the lateral bulbs, which it throws out, under ground, in considerable numbers. This variety is very prolific, and is useful when other sorts do not keep well. It is sometimes planted about midwinter, and then ripens in summer, but for use during the spring and early summer it is best planted in spring. It is also known as the underground onion, from its habit of producing its bulbs beneath the surface.

The *Tree Onion* or *Egyptian Onion*, *Allium Cepa proliferum*, produces small bulbs instead of flowers, and a few offsets also underground. These small stem bulbs are excellent for pickling.

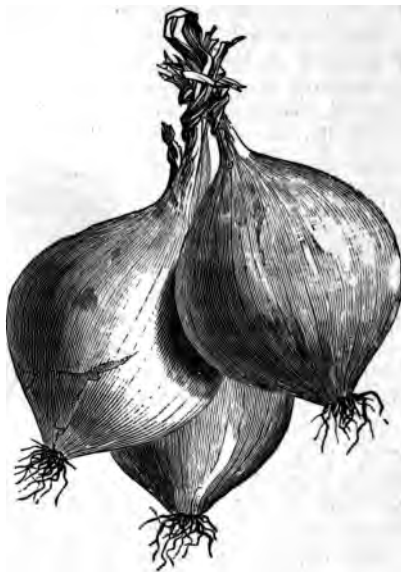


FIG. 200.—Onion ; Trébons.

The *Welsh Onion* or *Ciboule*, *Allium fistulosum*, is a hardy perennial, native of Siberia. It forms no bulbs, but, on account of its extreme hardness, is sown in July or early in August, to furnish a reliable supply of young onions for use in salads during the early spring. These bulbless onions are sometimes called Scallions, a name which is also applied to old onions which have run into stem and leaves, the bulbs being absorbed.

The following are among the best varieties of onions now grown :—

For summer and autumn.—The Queen ; Early White Naples : these two sorts are also excellent for sowing in autumn for spring salading. Silver-skinned ; Tripoli, including Giant Rocca.

For winter.—Brown Globe, including Magnum Bonum ; White Globe ; Yellow Danvers (fig. 199) ; White Spanish, in its several forms ; Trébons (fig. 200), the finest variety for autumn sowing, attaining a large size early, ripening well, and keeping good till after Christmas ; Strasburg (Deptford) ; Weathersfield Red ; Blood Red, strong-flavoured.

For pickling.—The Queen, Early Silver-skinned, White Nocera, Egyptian.

The *Orach* or *Mountain Spinach*, *Atriplex hortensis*, native of Tartary, is a tall-growing hardy annual, whose leaves, though coarsely flavoured, are used as a substitute for spinach, and to correct the acidity of sorrel. The White and the Green are the most desirable varieties. The plant should be grown quickly in rich soil. It may be sown in rows 2 feet apart, and about the same distance in the row, about March, and for succession again in June. If needful, water must be freely given, so as to maintain a rapid growth.

The *Oxalis crenata*, Oca of the South Americans, is a tuberous-rooted half-hardy perennial, native of Peru. Its tubers are comparatively small, and somewhat acid ; but if they be exposed to the sun from six to ten days, they become sweet and floury. In the climate of England they can only be grown by starting them in heat in March, and planting out in June in a light soil and warm situation. They grow freely enough, but few tubers are formed, and these of small size. The fleshy stalks, which have the acid flavour of the family, may, however, be used in the same way as rhubarb for tarts. The leaves may be eaten in salads. It is easily propagated by cuttings of the stems, or by means of sets like the potato.

The *Oxalis Deppei*, a bulbous perennial, native of Mexico, has scaly bulbs, from which are produced fleshy, tapering, white, semi-transparent roots, about 4 inches in length, and 3 to 4 inches in diameter. They strike down into the soil, which should therefore be made light and rich, with abundance of decayed vegetable matter.

The bulbs should be planted about the end of April, 6 inches apart, in rows 1 foot asunder, being only just covered with soil, and having a situation with a southern aspect. The plants should be dug up before they become affected by frost, and when taken up, the bulbs should be stored in a cool dry place for replanting, and the roots for use. The roots are gently boiled with salt and water, peeled and eaten like asparagus with melted butter and the yolks of eggs, or served up like salsafy and scorzonera with white sauce.

The *Parsnip*, *Pastinaca sativa*, is a hardy biennial, found in temperate regions. Its long tapering fleshy whitish nutritious roots have a peculiar but agreeable flavour. It succeeds best on a free sandy loam, which should be trenched and manured in the previous autumn, the manure being well buried. The seed should be sown thinly in March, in rows, 18 inches apart, and finally thinned out to 1 foot apart. The leaves will decay in October or November, when a portion of the roots may be taken up and stored in dryish sand for immediate use, the rest being left in the ground, to be taken up as required, but the whole should be removed by February to a dry cool place, or they will begin to grow. The best sorts are the Hollow-crowned, the Maltese, and the Student.

The *Pea*, *Pisum sativum*, is a hardy annual, climbing by means of the tendrils of its leaves, and has been cultivated from time immemorial. The seeds or pulse are very nutritious, whether eaten green or ripe, and those of the early crops are esteemed as luxuries.

The pea prefers a friable calcareous loam, deeply worked, and well enriched with good hotbed or farm-yard manure. The early crops require a warm sheltered situation, but the later are better grown 6 or 8 feet apart, or more, in the open quarters, dwarf crops being introduced between the rows. The dwarf or early sorts may be sown 3 or 4 feet apart. The deep working of the soil is of importance, lest the plants should suffer in hot dry weather from mildew or arrest of growth. The first sowing should be made about the beginning or middle of November, in front of a south wall, the plants being defended by spruce fir branches or other spray throughout the winter. In February sowings are sometimes made in flower-pots or boxes, and the young plants afterwards planted out. The main crop should be sown towards the end of February, and moderate sowings should be made twice a month afterwards, up to the beginning of July for the north, and about the third week in

July for warmer districts. During dry hot weather late peas derive great benefit from mulching and watering. The latest sowings, at the middle or end of August, should consist of the best early sorts, as they are not so long in producing pods as the larger and finer sorts, and by this means the supply may be prolonged till October or November. As they grow up the earth is drawn to the stems, which are also supported by stakes, a practice which in a well-kept garden is always advisable, although it is said that the early varieties arrive sooner at maturity when recumbent. The taller sorts are best sown in single rows at wide intervals of 20 or 30 feet.

Peas grown late in autumn are subject to mildew, to obviate which Mr Knight proposed to dig over the ground in the usual way, and to soak the spaces to be occupied by the rows of peas thoroughly with water,—the earth on each side to be then collected so as to form ridges 7 or 8 inches high, these ridges being well watered, and the seed sown on them in single rows. If dry weather at any time set in, water was to be supplied profusely once a week.

To produce very early crops the French market-gardeners sow early in November, in frames, on a border having a good aspect, the seeds being covered very slightly. The young plants are transplanted into other frames in December, the ground inside being dug out so as to be 18 or 20 inches below the sashes, and the earth thus removed placed against the outside of the frames. The young plants, when 3 or 4 inches high, are planted in patches of three or four, 8 inches asunder, in four longitudinal rows. The sashes are covered at night with straw mats, and opened whenever the weather is sufficiently mild. When 8 or 10 inches high, the stems are inclined towards the back of the frame, a little earth being drawn to their base, and when the plants come into blossom the tops are pinched out, above the third or fourth flower, to force them into bearing. As soon as they begin to pod, the soil may have a gentle watering, whenever sufficiently warmed by the sun, but a too vigorous growth at an earlier period would be detrimental. Thus treated the plants bear pods fit for gathering in the first fortnight in April.

A very convenient means of obtaining an early crop is to sow in 5-inch pots, a few seeds in each, the plants to be ultimately planted out on a warm border. Peas may also be obtained early if gently forced in frames, in the same way as kidney beans, the dwarfest varieties being preferable.

For the very early peas the rows should range east and west, but for the main crops north and south. The average depth of the

drills should be about 2 inches for small sorts, and a trifle more for the larger kinds. The drills should be made wide and flat at bottom, so that the seeds may be better separated in sowing. The large sorts are the better for being sown 3 inches apart. Chopped furze may be advantageously scattered in the drill before covering in, to check the depredations of mice, and before levelling the surface the soil should be gently trodden down over the seeds.

A good selection of sorts may be made from the following :—

Early : Dillstone's Early (Sutton's Ringleader, Carter's First Crop), the earliest sort ; Sangster's No. 1, a good form of Early Frame ; William I., fine ; Laxton's Alpha, the earliest wrinkled pea ; Dickson's First and Best ; Maclean's Little Gem, a very dwarf wrinkled pea ; Tom Thumb (Beck's Gem), a very dwarf round pea. The last two are useful for forcing and for pots.

Second Early : Maclean's Advancer, Standish's Criterion, Laxton's Marvel, Carter's Telephone, Dr Maclean, Premier, Carter's Stratagem.

Late : James's Prolific, Carter's G. F. Wilson, Veitch's Perfection ; Ne Plus Ultra, the finest of all late peas, but a little delicate in cold wet soils and seasons ; General Wyndham, continues to produce very late ; British Queen, Champion of England, Laxton's Omega.

The *Potato*, *Solanum tuberosum*, is a half-hardy perennial, producing underground tubers, largely used as an esculent. It thrives best in a rather light friable loam ; and in thin sandy soils the produce, if not heavy, is generally of very good quality. Soils which are naturally wet and heavy, as well as those which are heavily manured, such as old garden ground, are not suitable. Indeed it is best, except when there is ample space, to grow only the earlier kinds in gardens. If the soil is of fair quality, the less manure applied to it the better, unless it be soot or lime, though gypsum, bone-dust, superphosphate of lime, and nitrate of soda may also be used, and wood ashes are advantageous if the soil contains much vegetable matter.

Potatos are commonly propagated by dividing the tubers, leaving to each segment or "set" one or two eyes or buds. The "sets" are then planted by the aid of the dibble or spade, in rows at a distance varying from 15 inches to 3 feet, the distance being regulated by the height of the stems, and that between the sets varying from 6 to 12 inches, 8 inches being a good average space for garden crops, with 2 feet between the rows. The sets may be put in 6 inches deep. The late T. A. Knight suggested the planting of whole tubers or sets, at greater distances apart, by which means, he argued, a larger produce would be obtained ; he proposed to leave 4 feet between the rows, but that distance, except with the larger

varieties, has been found to be too great. Though the planting of whole tubers instead of the cut sets has been thus highly recommended, yet according to some experiments made in the garden of the Horticultural Society at Chiswick the cut sets yield a much better return than whole ones. The full-sized tubers are, however, preferable to smaller ones, as their larger buds tend to produce stronger shoots. It has also been found that the best returns are obtained from sets taken from the points of the tubers—not from their base. Mr Thomas Dickson of Edinburgh long ago observed that the most healthy and productive crop was to be obtained by planting unripe tubers, and proposed this as a preventive of the disease called the “curl,” which sometimes attacks the young stems, causing them and also the leaves to become crumpled, and few or no tubers to be produced. It has also been noted that the sprouting of the eyes of the potato may be accelerated if, while still unripe, it is taken up and exposed for some weeks to the influence of a scorching sun. The best sets are those obtained from plants grown in elevated and open situations, and it is also beneficial to use sets grown on a different soil.

The earliest crops should, if possible, be planted in a light soil and in a warm situation, towards the end of February, or as early as possible in March. In some cases the tubers for early crops are sprouted on a hotbed, the plants being put out as soon as the leaves can bear exposure. If the young sprouts are about 2 inches long, they may be planted out towards the end of March ; if they are protected young potatoes will be procured in seven or eight weeks. It will improve the crop if, when the stems have grown a few inches above ground, the earth is drawn up to them, but the operation will delay its maturity for two or three weeks. Mr Knight recommends removing the flowers as they appear, in order to increase the produce. The fine early varieties, however, scarcely produce any flowers.

The main crop should be planted by the middle of March, late planting being very undesirable. Those intended for storing should be dug up as soon as they are fairly ripe, unless they are attacked by the dire disease, in which case they must be taken up as soon as the murrain is observed ; or if they are then sufficiently developed to be worth preserving, but not fully ripe, the haulms or shaws should be pulled out, to prevent the virus passing down them into the tubers ; this may be done without disturbing the tubers, which can be dug afterwards.

Forcing.—The best forcing sorts are such as the Ash-leaf, a kidney ;

and the Early Market or Rector of Woodstock, a round. The earliest crop may be planted in December, and successional ones in January and February. The mode of cultivation adopted by the London market gardeners is thus in substance explained by Mr Cuthill. A long trench, 5 feet wide and 2 feet deep, is filled with hot dung, on which soil to the depth of 6 inches is put. The sets employed are middle-sized whole potatoes, which are placed close together over the bed, covered with 2 inches of mould, and then hooped and protected with mats and straw, under which conditions they will sprout in about a month. A bed of the requisite length (sometimes 100 yards) is then prepared of about 2 feet thickness of hot dung, soil is put on to the depth of 8 inches, and the frames set over all. The potatoes are then carefully taken up from the striking bed, all the shoots being removed except the main one, and they are planted 4 inches deep, radishes being sown thinly over them and covered lightly with mould. When the haulm of the potato has grown to about 6 inches in height, the points are nipped off, in order to give the radishes fair play; and, although this may stop growth for a few days, still the potato crop is always excellent. After planting nothing more is required but to keep up the temperature to about 70°, admitting air when practicable, and giving water as required. The crop is not dug up until it has come to maturity.

Potatoes are also grown largely in hooped beds on a warm border in the open ground. The sets after having been sprouted, as above, are planted out in January in trenches 2 feet deep filled with hot dung, the sets being planted 5 inches deep, and over all radishes are sown. The ridges are then hooped over, allowing about 2 feet of space in the middle, between the mould and the hoop, and are covered with mats and straw, but as soon as the radishes come up they are uncovered daily, and covered again every night as a protection against possible frosts. This is continued till the potatoes are ready for digging in May.

Potatoes are sometimes grown in pots in heat, sprouted sets being planted in 11-inch pots about two-thirds full of soil, and placed near the glass in any of the forcing-houses, where a temperature of from 65° to 70° is to be maintained. The plants are duly watered and earthed up as they advance in growth.

Small supplies of young waxy tubers are produced during winter, in boxes placed in a mushroom-house or in a common cellar. If in October old seed tubers are placed in layers, alternately with a mixture of tree leaves and light mould, the young tubers before mid-

winter will often attain the size and appearance of early potatoes; they are, however, watery, and possess little flavour.

The varieties of the potato are very numerous, and much attention has been paid during the last few years to the production of new and improved kinds. The following are named as a limited selection of a few of the standard sorts in the several groups, those marked * having coloured skins, the rest being white:—

Early.—*Round*: Early Market, Rector of Woodstock, Porter's Excelsior, *Triumph, *Radstock Beauty, Bedford Prolific, Breese's Climax. *Kidney*: Old Ash-leaf, Myatt's Ash-leaf, Avalanche, Snowflake, International Kidney, *Bountiful, *Beauty of Hebron.

Main Crop and Late.—*Round*: Schoolmaster, Regent, *Vicar of Laleham, Victoria, *Gramplan, *Vermont Beauty, Champion. *Kidney*: Covent Garden Perfection, Lapstone, Woodstock Kidney, *Trophy, Magnum Bonum, *Late American Rose, Cattell's Eclipse.

The *Radish*, *Raphanus sativus*, is a fleshy-rooted annual, unknown in the wild state. Some varieties of our wild radish, *R. Raphanistrum*, however, met with on the Mediterranean coasts, come so near to it as to suggest that it may possibly be a cultivated race of the same species. It is very popular as a raw salad. There are two principal forms, the spindle-rooted and the turnip-rooted.



FIG. 201.—Radish; Early Dwarf Scarlet Turnip.



FIG. 202.—Radish; White-tipped, Olive-shaped.

The radish succeeds in any well-worked not too heavy garden soil, but requires a warm sheltered situation. The seed is generally sown broadcast, in beds 4 to 5 feet wide, with alleys between, the beds requiring to be netted over to protect them from birds. The earliest crop may be sown about the middle of December, the seed-beds

being at once covered with litter, which should not be removed till the plants come up, and then only in the daytime, and when there is no frost. If the crop succeeds, which depends on the state of the weather, it will be in use about the beginning of March. Another sowing may be made in January, a third early in February, if the season is a favourable one, and still another towards the end of February, from which time till October a small sowing should be made every fortnight or three weeks in spring, and rather more frequently during summer. About the end of October, and again in November, a late sowing may be made on a south border or bank, the plants being protected in severe weather with litter or mats. The winter radishes, which grow to a large size, should be sown in the beginning of July and in August, in drills from 6 to 9 inches apart, the plants being thinned out to 5 or 6 inches in the row. The roots become fit for use during the autumn. For winter use they should be taken up before severe frost sets in, and stored in dry sand.

Forcing.—To obtain early radishes a sowing should be made about the beginning of November, and continued fortnightly till the middle or end of February; the crop will generally be fit for use about six weeks after sowing. The seed should be sown in light rich soil, 8 or 9 inches thick, on a moderate hotbed, or in a pit with a temperature of from 55° to 65°. Gentle waterings must be given, and air admitted at every favourable opportunity; but the sashes must be protected at night and in frosty weather with straw mats or other materials. Some of these crops are often grown with forced potatoes. The best forcing sorts are Wood's Early Frame, and the Early Rose Globe, Early Dwarf-top Scarlet Turnip, and Early Dwarf-top White Turnip.

Those best suited for general cultivation are the following :—

Spindle-rooted: Long Scarlet, including the sub-varieties Scarlet Short-top, Early Frame Scarlet, and Wood's Early Frame; Long Scarlet Short-top, best for general crop.

Turnip-rooted: Early Rose Globe-shaped, the earliest of all; Early Dwarf-top Scarlet Turnip (fig. 201), and Early Dwarf-top White Turnip; Earliest Erfurt Scarlet, and Early White Short-leaved, both very early sorts; French Breakfast, olive-shaped (fig. 202); Red Turnip, and White Turnip, for summer crops.

Winter sorts: Black Spanish, White Chinese, Californian Mammoth.

The *Rampion*, *Campanula Rapunculus*, is a tap-rooted biennial, native or naturalized in the south of England, and found on banks and in pastures in central and southern Europe, extend-

ing to the Caucasus. The white fleshy roots, known as "ramps," are used raw as a salad, or boiled like asparagus. It is but little cultivated in England. The seed, which is very minute, and should be mixed with sand before sowing to secure even distribution, is sown in drills 6 to 8 inches apart, about the end of May or beginning of June, in deeply worked ground, and in a cool situation, and the young plants are merely to be thinned and kept clear of weeds. The roots, which somewhat resemble small radishes, will be fit for use about November, and on the approach of frost, if taken up and stored in sand, they will keep fresh and firm till spring.

The *Rhubarb* of gardens is derived from different species of *Rheum*, especially *R. Rhaponticum* and *R. undulatum*. The parts chiefly utilized are the fleshy foot-stalks of the leaves, which are much used for preserves, puddings, and tarts, or for stewing.

Rhubarb requires an open situation and a rich deep soil, which should be well manured, and prepared by deep trenching. To form a plantation, divisions of the old roots, each provided with a bud or crown, should be put in early in spring, the crown being set about 2 inches below the surface. They should stand 3 to 4 feet apart each way, according to the habit of the variety. The plants will afford a supply in the following spring. It is desirable to renew the plantation in the course of four or five years, shifting to new ground. When gathering the crop, the leaf-stalks should be bent downwards, and pulled off sideways, not cut. The flower-stems should be cut off as soon as they make their appearance, in order to strengthen the root. Established sorts must be increased by division, as seedlings do not reproduce the variety. Rhubarb may, however, be grown from seeds—a flower stem or two being allowed to grow up for the purpose of producing them. The seeds should be sown on a slight hotbed in spring, and transplanted out in rows in the month of May, no stalks being gathered from them for the first two years.

Forcing.—Rhubarb may be forced in a variety of ways for early or winter use; it may have a pot or box set over the crown and covered up by warm litter, dung, or leaves like sea-kale; or the roots may be taken up, potted, and set into any forcing-house at work, the crowns being kept in the dark so as to blanch the stalks; or they may be planted closely in long narrow boxes of moderate depth, and set in a mushroom-house or cellar, where there is a considerable temperature. The rhubarb will soon throw up its

stalks, and these, being partially etiolated, possess a delicacy and flavour superior to those grown in the open air. It is easy, by varying the time of subjecting the boxes to the increased temperature, to keep up a succession of rhubarb stalks, from the period at which kitchen apples become scarce or begin to lose their flavour, till green gooseberries come into season.

The favourite old sorts of rhubarb were the Tobolsk and the Elford or Buck's; the latter comes from *R. undulatum*, and is one of the best in flavour, as well as of a fine red colour. Other good sorts of more modern date are Mitchell's Royal Albert, Dancer's Early Scarlet, Myatt's Linneus, and Myatt's Victoria, the last a large-growing thick-stalked kind, the others being all earlier sorts. Johnson's St Martin's and Salt's Crimson Perfection are also favourite kinds; and Stott's Monarch grows to a very large size.

The *Rocamboles*, *Allium Scorodoprasum*, is a hardy European bulbous perennial, occurring in a wild state in sandy pastures and wastes; in Britain it is found chiefly in the north of England and south of Scotland. The plant is grown for the sake of its bulbs, which are smaller and milder than those of garlic, and consist of several cloves. The cloves should be planted about the end of February or in March, and treated like the garlic or shallot. When mature, the bulbs should be taken up, dried, and stored for use.

The *Salsafy* or *Salsify* (fig. 203), *Tragopogon porrifolius*, is a hardy biennial, with long cylindrical fleshy esculent roots, which, when properly cooked, are extremely delicate and wholesome; it occurs in meadows and pastures in the Mediterranean region, and, in Britain, is confined to the south of England. The salsafy requires a free rich deep soil, which should be trenched in autumn, the manure used being placed at two spades' depth from the surface. The first crop should be sown in March, and the main crop in April, in rows a foot from each other, the plants being afterwards thinned to 8 inches apart. In November the whitish roots should be taken up and stored in sand for immediate use, others being secured in a similar way during intervals of mild weather.

The *Savoy*, *Brassica oleracea bullata major*, is a near ally of the cabbage, but has bullate or blistered leaves; it is more hardy, and, except in very severe seasons, instead of suffering is rather improved in flavour by frost. The savoys come into use in autumn, and continue until the spring. The early crop should be sown in February, the main crop about the middle of March, and a month

afterwards the latest crop. The rows of the smaller sorts should be planted at about 15 inches, and those of the larger ones about 2 feet, apart.

The best sorts of savoys for garden culture are :—

Tours, early and hardy ; Ulm, early, but not so hardy ; Little Pixie, small, early, and good ; Dwarf Green Curled, best for a general crop ; Golden, handsome and excellent. The large Drumhead savoy is more suitable for field culture, where bulk of produce is required.

The *Scorzonera* (fig. 204), *Scorzonera hispanica*, is a hardy per-



FIG. 203.—Salsafy.



FIG. 204.—Scorzonera.

ennial, a native of Spain, but cultivated in gardens for its fleshy cylindrical roots, which resemble those of salsafy except in being black outside, and are used in the same manner. They should be treated in every respect like salsafy.

The *Sea-kale* (fig. 205), *Crambe maritima*, is a hardy perennial, growing spontaneously along the coasts of England, of Ireland, and of the Scotch lowlands, along the western coasts of Europe, and on the Baltic, reappearing on the Black Sea.

Sea-kale prefers a light dry soil, and when manure is necessary it should consist of sea-weed or well-rotted dung; or a dressing of salt or of nitrate of soda may be given. When it is raised from seeds, they should be sown in March or April in rows a foot asunder, the



FIG. 205.—Sea-kale

plants being thinned to 6 inches apart. In the following March these should be planted out in trenched well-prepared ground, 2 feet asunder, in rows $2\frac{1}{2}$ to 3 feet apart. The top with the crown buds should be cut off before planting to prevent them from running up to seed. In the spring of the second year the young shoots if blanched will be fit for use, and therefore the summer growth should in every way be promoted by the use of water and liquid manure. Plants which are two summers old from the seed, will have acquired sufficient strength to bear the necessary blanching pro-

cess. The seeds, instead of being sown in rows and transplanted, may be deposited in patches of three or four together, where they are to remain. In the autumn, after the leaves have been cleared off, the ground should be forked up, and 6 or 8 inches' depth, or more, of leaves or of light sandy soil laid over the plants, by which means they will be blanched, though not forced. The blanched sprouts should be cut for use whilst they are crisp, compact, and from 3 to 6 inches in length, the stem being cut quite down to the base.

Sea-kale beds may be made equally well from cuttings of the roots, the extremities of the roots, technically called "thongs," being the parts best adapted for this purpose. They should be taken up in autumn, cut into lengths of about 4 inches, and laid aside in a heap of sand or earth till spring, when they should be planted out like the seedlings. These cuttings should not be taken from any but very healthy plants.

Forcing.—Sea-kale may be forced in the open beds by the aid of sea-kale pots or covers, which are large enough to cover a plant, contracted a little at top, with a movable lid or cover. In the autumn the stalks are cut over, the decayed leaves removed, the ground loosened about the eyes, and a thin stratum of coal-ashes mixed with salt laid on the surface to keep down earth-worms. One of the earthenware pots or covers, or failing these a large inverted flower-pot, is placed over each plant or each patch of plants, and leaves of trees are closely packed round the pots, and raised to about a foot above them. When fermentation commences, a thermometer should be occasionally introduced into a few of the pots, to ascertain that the temperature within does not exceed 60° Fahr., and the thickness of the leaves is to be regulated accordingly. In a month or six weeks the shoots will be ready for cutting, and by means of the movable lids they can be examined and the shoots gathered without materially disturbing the covering. If the crowns are thus covered up by about the end of October, the crop may be cut by about the third week of December, and by starting successive batches a supply may be had up till the middle of May.

Strong plants may also be taken up and planted on hotbeds, the sashes being kept covered close; or they may be set thickly in boxes as recommended for rhubarb, and placed in any heated structure, or in the mushroom house; but, to have the shoots crisp and tender as well as blanched, light must be completely excluded. Besides the common purple-leaved, there is a green-leaved sort, which is said to blanch better.

The *Shallot*, *Allium ascalonicum*, is a native of Palestine, and is much used in cookery for high-flavoured soups and gravies, besides which it is excellent when pickled. It is a hardy bulbous perennial, and is propagated by offsets, which are often planted in September or October, but the principal crop should not be got in earlier than February or the beginning of March. The mixing of soot with the surface soil has been recommended as a protection against maggots. In planting, the tops of the bulbs should be kept a little above ground, and it is a commendable plan to draw away the soil surrounding the bulbs when they have got root-hold. They should not be planted on ground recently manured. They require the same general treatment as garlic and rocambole, and should be stored in a similar manner. They come to maturity about July or August. There are three sorts—the Common; the Jersey or Russian, much larger and less pungent; and Pond's Jersey White, a novelty.

The *Skirret*, *Sium Sisarum*, is a fleshy-rooted perennial, native of China and Japan, the roots of which are boiled, and afterwards served up like salsafy. It requires a free, deep, and much enriched soil, and is generally raised from seeds, which should be sown in drills a foot apart about the end of March, the bed being well-watered in dry weather. The roots will be in use about November, and will continue fresh through the winter if carefully stored.

The *Sorrel*, *Rumex Acetosa*, is a hardy perennial, found throughout Europe, in Asiatic Russia, and in North America. The leaves are used, more so on the Continent than in Britain, in soups, salads, and sauces. Sorrel grows freely in any good garden soil, and is increased by dividing the roots during the early part of spring. They should be planted in rows 15 to 18 inches apart. The leaves, when fully grown, are gathered singly.

The common garden sorrel is much superior to the wild plant; but the Belleville, which is the kind generally cultivated near Paris, is still better, its leaves being larger and not so acid. The Blistered-leaved, which has large leaves with a blistered surface, has the advantage of being slow in running to seed.

The *French Sorrel*, *Rumex scutatus*, is a hardy perennial, native of France and Switzerland, with densely-branched trailing stems. The leaves are roundish heart-shaped and glaucous; they are more acid than those of the common sorrel.

The *Spinach*, *Spinacia oleracea*, is an annual plant, which has been long cultivated for the sake of its succulent leaves. It should be grown on good ground, well worked and well manured ; and for the summer crops abundant watering will be necessary.

The first sowing of winter spinach should be made early in August, and another towards the end of that month, in some sheltered but not shaded situation, in rows 18 inches apart, the plants, as they advance, being thinned, and the ground hoed. By the beginning of winter the outer leaves will have become fit for use, and if the weather is mild successive gatherings may be obtained up to the beginning of May. The Prickly-seeded and the Flanders are the best for winter ; and these should be thinned out early in the autumn to about 2 inches apart, and later on to 6 inches. The Lettuce-leaved is a good succulent sort, but not quite so hardy.

To afford a succession of summer spinach, the seeds should be sown about the middle of February, and again in March ; after this period small quantities should be sown once a fortnight, as summer spinach lasts but a very short time. They are generally sown in shallow drills between the lines of peas. If a plot of ground has to be wholly occupied, the rows should be about a foot apart. The Round-leaved is the best sort for summer use.

The *Tomato* or *Love Apple*, *Lycopersicum esculentum* or *Solanum Lycopersicum*, is a tender annual from South America, much esteemed in England as an esculent, either raw or cooked.

Tomatos were formerly raised from seed sown in gentle heat in February or early in March, potted singly into small pots, shifted on into larger pots, and gradually exposed to the air till about the end of May, when, if the season was favourable, they were planted out against a wall with a south aspect, or in the warmest situation at command. As they grew, they were nailed to the wall, or otherwise supported. Only the earlier of the fruit ripened out of doors in an average season ; and when a fair quantity had set, the plants were stopped, the secondary branches being also stopped above the fruit, and laterals removed gradually. Under these circumstances the fruit began to ripen in August, successively coming to maturity, at which stage, and when perfectly dry, it had to be gathered and hung up or laid on shelves. The partially ripened fruit had to be got in before it was injured by frost, its maturation being completed in a vinery or other heated house, and, though not acquiring the full flavour, the forwardest of these late fruits thus became usable.

Forcing.—The outdoor treatment remains as above sketched out, but, owing to the precarious nature of the crop in bad seasons, large quantities are now grown under glass. Mr G. T. Miles, of Wycombe Abbey Gardens, has explained in the *Gardeners' Chronicle* his mode of culture, of which the following is an abstract:—

“To grow it properly, it requires considerable heat and every possible ray of sunshine, as well as a free circulation of dry warm air. The compost should consist of about one-half rough turfy loam, one-fourth of roadside

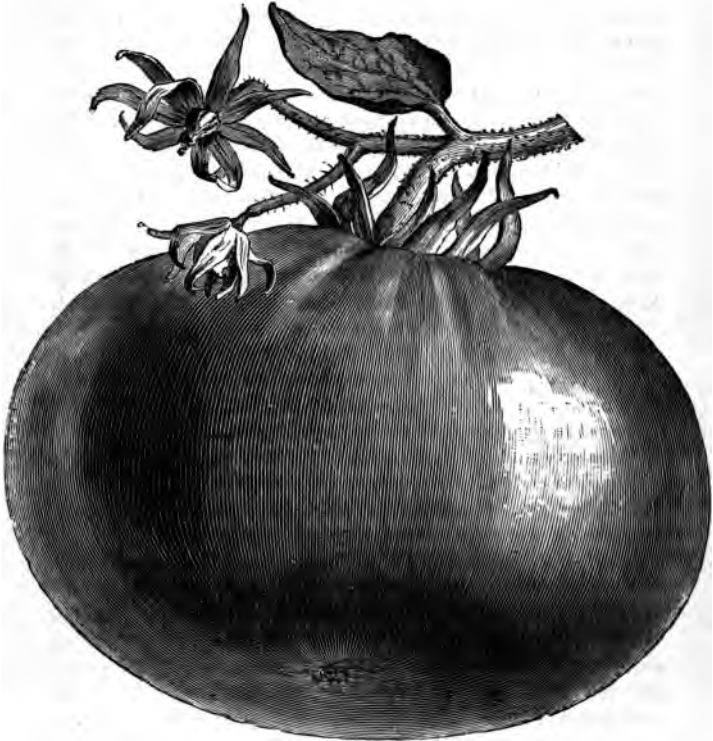


FIG 206.—Tomato; Trophy.

scrapings, and one-fourth of decomposed manure or horse-droppings, moderately fresh. For planting out, a ridge of soil 2 feet wide and 15 inches deep should be placed on a warm bed of tan or leaves. For pot cultivation those from 12 to 15 inches in diameter are most appropriate, and these should not be quite filled, in order that surface dressings of the same material or of pure

manure may be applied afterwards. For early work a sowing should be made in January, and the plants moved onwards until they have moderately filled 5-inch pots with roots, when they are transferred to the beds or fruiting-pots; in each case the plants are kept about 2 feet apart. Other sowings may be made at intervals till about the end of August. From the last sowing a supply is obtained for a considerable period onwards through the winter months. The plants are restricted to one main stem, which is allowed a run of 6 feet or more, as the position may admit, and from this all laterals are removed in an early stage of growth. Top-dressings of rich materials should be applied when the surface soil becomes full of roots; copious supplies of stimulating manure-water are also necessary, and the fruits should be kept perfectly free from damp while they are ripening. For this purpose, if close confined pits are used, a chink of air should be kept on continuously."

Tomatos may also be allowed to run freely over the back wall of a forcing house, and, if sufficiently fed, will bear fruit abundantly.

Mr Miles observes that these plants, when grown out of doors, are generally placed in an excellent position, but the main point—the enrichment of the soil—is overlooked or not sufficiently attended to. A portion of good soil should be provided for each plant, and heavy mulchings of manure should be placed upon the surface as soon as practicable after planting, in order to prevent the soil becoming dry and parched. In these cases three or more main shoots are allowed to each plant, because it often happens that the space will not allow a good run, and a certain amount of growth with foliage is essential to the well-doing of the plants.

The following varieties afford considerable choice :—

Red-fruited : Early Gem, small, but a good cropper, and the quickest to ripen; Vick's Criterion, small and free-bearing, particularly adapted for growing in small pots; Vilmorin's Dwarf Early, dwarf and free-bearing; Hathaway's Excelsior, one of the finest, a great cropper; Trophy, large and very fine (fig. 206); Conqueror, large and prolific.

Yellow-fruited : Carter's Green Gage, of a distinct yellow colour, and of fine flavour.

Smaller-fruited : Cherry Red and Burghley Pet, round, prolific, and agreeably flavoured; Dickson's Queen of Tomatos, with pear-shaped, and Nesbit's Victoria, with plum-shaped fruits, are both prolific sorts.

The *Turnip*, *Brassica campestris* Rapa, is a hardy biennial, found in corn-fields in various parts of England. The cultivated varieties have bulbiform roots, much esteemed as an esculent.

Turnips should be grown in a rich friable sandy loam, such as will produce medium-sized roots without much aid from the manure heap, and are better flavoured if grown in fresh soil. In light dry soils well decomposed hotbed or farmyard manure is the best that can be used, but in soils containing an excess of organic matter, bone dust, superphosphate of lime, wood-ashes, or guano, mixed with

light soil, and laid in the drills before sowing the seed, are beneficial by stimulating the young plants to get quickly into rough leaf, and thus to grow out of reach of the so-called turnip fly. To get rid of this pest, it has been found beneficial to dust the plants with quicklime, and also to draw over the young plants nets smeared with some sticky substance like treacle, by which large numbers will be caught and destroyed. It has been also recommended as a palliative to sow thick in order to allow for a percentage of loss from this and other causes, and, as a preventive, to scatter gas-lime over the surface after the seed has been sown. Mr Thompson (*Gardener's Assistant*) also recommends the following remedy:—"In the first place, let a supply of water be brought close to hand, or say to each end of the quarter; then let one person move steadily along one side of the piece of ground from one end to the other, delivering the water through a rose as he proceeds. The fleas will jump forward as the water approaches them, and a second person, following the first, will keep them on the hop forward, whilst a third will drive them still further, and so on till the whole are driven off the ground."

The first sowing should be made on a warm border with the protection of a frame or matted hoops, in January or February, the second on a well-sheltered border in March, after which a sowing once a month will generally suffice. In May and June the plot should be in a cool moderately shaded position, lest the plants should suffer from drought. The principal autumn and winter sowings, which are the most important, should be made about the end of June in the northern districts, and in the beginning of July in warmer districts; a small sowing may be made at the end of August to come in before the spring-sown crops are ready. If the weather is showery at the time of sowing, the seed speedily germinates, and the young plants should be kept growing quickly by watering with rain or pond water and by surface stirrings. The drills for the earliest sorts need not be more than 15 inches apart, and the plants may be left moderately thick in the row; the late crops should have at least



FIG. 207.—Turnip: Jersey Navet.

2 feet between the rows, and be thinned to 12 inches in the row, a free circulation of air about them being very important in winter. As a provision against prolonged periods of severe weather, it has been recommended to lay the finest roots in rows, covering them well with soil, and leaving intact the whole of the foliage. The very latest sown crops of half-grown roots will prolong the supply until the earliest spring-sown crops are fit for use.

The following are the best sorts of turnips for garden crops:—

Early Purple-top Munich, the earliest and best of all; Early White Strap-leaf, very quick growing, and good; Early Snowball, for summer use; Early White Stone, for summer sowing; Orange Jelly, for summer sowing; Yellow Finland, for winter use; Chirk Castle, for winter use. In addition to these, which have round roots, there are the Jersey Navet (fig. 207), an excellent oblong variety, and very hardy, and the Teltow, a small tapering-rooted sort, employed, on account of its piquant flavour, in ragouts, and for seasoning. The latter should be sown in April and July in sandy soil.

The *Water Cress*, *Nasturtium officinale*, is a hardy perennial, occurring wild in Britain, and also throughout Europe and Asiatic Russia, except the extreme north. It is highly prized as a salad, and accredited with powerful antiscorbutic properties. It may be propagated from seed, but in forming plantations rooted divisions are usually employed. They should occupy positions where they can be supplied with water from a spring, as this will be rarely frozen. The plant will not grow freely on a muddy bottom; hence this has to be replaced by gravel or chalk. A constant current of water is absolutely necessary; and the plants should be disposed in rows parallel with the course of the stream. They thrive best in water about 1½ inch in depth; this increases to about 3 inches when the plants begin to grow, and thereby check the current. In summer the tops of the plants must be kept closely cut, and under proper conditions of water and soil they will yield a gathering once a week. In winter the water should be 4 to 5 inches deep, to obtain which the plants are left with more head. The time for the renewal of the beds is in May and June, and from September to November, the planting being done in succession; those planted in May are fit to cut by August, and those planted in November are ready to gather in the spring. When collected for sale or use, the shoots are cut, not broken off, the latter being injurious. The water cress may also be grown in a shady border of rich light soil, kept constantly moist; but the surface should be covered with a thin layer of sand to keep the leaves clean. It may be also grown in tubs partially filled with soil which is covered with water, in which case the

water should be frequently changed, or in shallow pans set in stands of water. If protected from frost in a brick pit with a slight service of hot-water piping, it may be had in use through the winter. To secure this, pans are filled with loamy soil in October or November, and planted with the tops of outdoor cresses; in about six weeks they will be fit to cut, and will furnish successive gatherings.

The *Chinese Yam*, *Dioscorea Batatas*, is a fleshy-rooted perennial climber, native of China. It has annual stems, and deeply penetrating thick club-shaped fleshy roots, or rhizomes, full of starch, which when cooked acquire a mild taste like that of a potato, but have besides somewhat of a medicinal flavour. The roots grow 3 feet or upwards in length, and sometimes acquire a weight of more than 1½ lb. The plant grows freely enough in deep sandy soil, moderately enriched. The sets, consisting of pieces of the roots, may be planted in March or April, and require no other culture than the staking of the climbing stems. They should not be dug up before November, the chief increase in their size taking place in autumn. They sometimes strike downwards 2 or 3 feet into the soil, and must be carefully dug out, the upper slender part being reserved for propagation, and the lower fleshy portion eaten after having been allowed a few days to dry.

CULINARY HERBS.

Besides the foregoing esculent and salad plants, there are several minor herbs used for flavouring and garnishing. For the most part they are dwarf perennial plants requiring to be grown on a dry warm soil in an open sunny aspect, or annuals for which a warm sheltered border is the most suitable place; and they may therefore be conveniently grown together in the same compartment—an herb garden. The perennials should be transplanted either every year or every second year.

For winter use the tops of the most useful kinds of herbs should be cut when in flower or full leaf and quite dry, and spread out in an airy but shady place so as to part slowly with the moisture they contain, and at the same time retain their aromatic properties. When quite dry they should be put into dry wide-mouthed bottles and kept closely corked. In this way such herbs as basil, marjoram, mint, sage, savory, and thyme of the aromatic class, and balm, chamomile, horehound, hyssop, and rue of the

medicinal class, as well as parsley, may be had throughout the season with almost the full flavour of the fresh herb.

Angelica, *Archangelica officinalis*.—A stout biennial umbellifer; sow in April, in deep rich soil. The stems and leaf-stalks are candied.

Anise, *Pimpinella Anisum*.—A slender umbelliferous annual; sow in May in light warm soil; English summers are scarcely warm enough to bring it to perfection.

Balm, *Melissa officinalis*.—A hardy labiate perennial; divide the roots in October; dry for winter use.

Basil, *Ocimum Basilicum*.—A fragrant labiate annual; sow in a gentle heat in March, and plant out on a warm border; or sow in a warm sheltered place in April or May; or in winter sow in heat (65°–70°) in pots or boxes in rich light soil, once a month from November onwards; that sown in April or May should be cut when in blossom, and dried slowly for winter use.

Borage, *Borago officinalis*.—A stout native British annual, used for garnishing, and cool tankards; sow in March and May in an open place, in good soil.

Burnet, *Poterium Sanguisorba*.—A hardy native perennial; divide the roots in October or February. It tastes like cucumber.

Caraway, *Carum Carui*.—A hardy umbelliferous biennial; sow in April or May to flower the following summer.

Chamomile, *Anthemis nobilis*.—A hardy native British composite perennial of prostrate habit; divide the plants in autumn or spring, planting in rather poor dry soil; the flower-heads should be gathered successively as they open, and carefully dried and stored.

Chervil, *Anthriscus Cerefolium*.—A hardy annual umbellifer; sow in March, and again in October if required for spring use.

Coriander, *Coriandrum sativum*.—A hardy annual umbellifer; sow in March in light loamy soil.

Dill, *Anethum graveolens*.—A hardy annual umbellifer; sow in March on a warm border, in rich light soil.

Fennel, *Foeniculum vulgare*.—A hardy perennial umbellifer; sow in March, or divide the roots at the same season.

Finocchio, *Foeniculum dulce*.—A somewhat tender kind of fennel, with two-ranked leaves, fleshy at the base, which part is blanched by earthing up like celery; sow in March and successionally if required, in light very rich soil.

Horhound, *Marrubium vulgare*.—A hardy native labiate perennial, best raised annually from seeds sown early in March, or by selecting self-sown autumn seedlings.

Hyssop, *Hyssopus officinalis*.—A hardy evergreen suffruticose labiate plant; sow in March or April, young plants being more vigorous than older ones; it may also be divided in spring.

Lavender, *Lavandula vera*.—An aromatic undershrub of the labiate order, requiring a light warm dry soil, and increased by cuttings, or by slips taken off with roots about March or April.

Marigold, *Calendula officinalis*.—A hardy composite annual; sow in March, in any garden soil. Used for flavouring and colouring.

Marjoram, *Origanum Majorana*.—A tender labiate, usually treated as an annual, and known as Knotted Marjoram; sow in March in a slight heat, and plant out on a warm sunny border. The *Pot Marjoram*, *Origanum Onites*, and *Winter Sweet Marjoram*, *Origanum heracleoticum*, are hardy perennials, growing best in dry warm soils; divide and transplant in autumn or spring; a winter supply is provided by cutting the stems, when the plant is in flower, and drying in an airy shady place.

Mint, *Mentha viridis*.—A hardy native labiate perennial, often called Spear-Mint. The running underground roots should be taken up in February or March, and replanted in fresh good soil. The young tops may be obtained early by forcing; the leafy stems may also be cut when at their full growth in summer, and dried for winter use. The *Peppermint*, *Mentha piperita*, is cultivated like the spear-mint, only its runners grow above instead of beneath the ground, and require planting accordingly.

Parsley, *Petroselinum sativum*.—A hardy umbelliferous biennial; sow in February, again in May, and again in July to have a good supply, a portion of the last-sown crop being protected by frames or hand-lights, so as to be accessible in frosty weather; it likes a free soil of good quality, but not too richly manured.

Pennyroyal, *Mentha Pulegium*.—A hardy native labiate perennial, growing in moist situations, and best cultivated on a north border, is propagated freely enough by its running rooting stems, which should be well established early in autumn.

Rosemary, *Rosmarinus officinalis*.—An evergreen undershrub of the labiate order, just tender enough to be killed in all but the most sheltered situations by the most severe British winters, but surviving uninjured through those of ordinary severity. It requires a light dry soil and a sheltered situation, and is increased by cuttings or rooted slips taken off in spring.

Rue, *Ruta graveolens*.—A hardy evergreen rutaceous undershrub, which will grow freely in ordinary garden soil, and is propagated by cuttings or slips, or very freely by seeds, which ripen abundantly.

Sage, *Salvia officinalis*.—A hardy evergreen undershrub, belonging to the labiates, of which there are two varieties, the green-leaved and the red-leaved, the latter being somewhat the hardiest; it is increased by earthing up the outside stems, which after the lapse of a year may be taken off as rooted plants in the following April or May.

Savory, *Satureja hortensis*.—A hardy labiate annual; sow on a warm border in April; when the plants reach the flowering stage, dry a portion for winter use. The *Winter Savory*, *Satureja montana*, a hardy evergreen undershrub, is propagated by cuttings taken off in April and May, or by dividing the plant about April.

Tansy, *Tanacetum vulgare*.—A hardy composite native perennial, which soon grows thick and exhausts the soil, and should therefore be divided and transplanted every second year. If required earlier than the natural season, a root or two may be potted and set in a mild forcing-house or hotbed.

Tarragon, *Artemisia Dracunculus*.—A hardy perennial composite plant, which grows freely in light dryish soil, and is increased by division in

October or March ; it should be transplanted every year or two. Tarragon may be had during the winter by potting a root or two early in December, and placing them in heat.

Thyme, *Thymus vulgaris*.—A hardy evergreen underahrub, requiring a light dry warm soil, and an open but sheltered situation ; it may be raised from seeds sown in April, and thinned out ; or the old roots may be divided about April. The tops should be cut in summer, and preserved for winter use in the same way as savory and marjoram. The *Lemon Thyme*, *Thymus citriodorus*, is of a more decumbent habit, and may be parted and transplanted in spring in genial weather during the month of April.

Wormwood, *Artemisia Absinthium*.—A hardy native composite perennial, which will grow in any soil, but is most aromatic on those which are dry and poor. The plants should be replaced annually in autumn, when self-sown plants are generally to be found round about the old ones ; if not so produced, they can be provided by sowing the seeds during the summer.

CHAPTER IX.

CALENDAR OF GARDEN OPERATIONS *For Great Britain.*

JANUARY.



KITCHEN GARDEN.—Wheel out manure and composts during frosty weather; trench vacant ground not turned up roughly in autumn. Sow early peas in a cold frame for transplanting. Sow also Dillistone's Early, Alpha, or other first-crop peas, early in the month, and William I. and Advancer towards the end; Early Seville and Early Longpod beans; and Short-topped radish in two or three sowings, at a week's interval, all on a warm border; also Hardy Green and Brown Dutch lettuce in a frame or on south border. Plant shallots and Ashleaf potatoes on a warm border. Protect broccoli as it becomes fit for use, or remove to a dry shed or cellar; lettuces and endive, which are best planted in frames; and parsley in frames, so as to be accessible.

Fruit Garden.—Plant fruit trees in open weather, if not done in autumn, which is the proper season, mulching over the roots to protect them from frost, and from drought which may occur in spring. Prune fruit trees in mild weather or in moderate frosts, nailing only in fine weather. Wash trees infested with insects, with a mixture of soap-suds, black sulphur, and tobacco water, or with Gishurst Compound. Take off grafts, and lay them aside in moist earth in a shady place.

Forcing.—Prepare manure for making up hotbeds for early cucumbers and melons, where pits heated with hot water are not in use; also for Ashleaf potatoes. Sow also in heat mustard and cress for salads, onions for salads; celery to be pricked out for an early crop; and Early Horn carrot and kidney-beans on slight hotbeds. Force asparagus, sea-kale, and rhubarb, in hotbeds, in pits, in the

mushroom-house, or in the open garden by the use of covers surrounded with warm litter. For pines keep up a bottom heat of 80°, and water sparingly; for cucumbers a top heat of 75°; for vines in leaf and flower a temperature ranging from 65° to 75°. Keep forced strawberries with swelling fruit well watered. Plant vine eyes for propagation in a brisk heat.

Plant Houses.—Give abundance of air to the greenhouse, conservatory, and alpine frame in mild weather, but use little water. A supply of roses, kalmias, rhododendrons, &c., and of hardy flowers and bulbs, as lily of the valley, hyacinths, &c., should be kept up by forcing.

Flower Garden.—Plant out tubers and bulbs of border flowers, where neglected in autumn, deferring the finer florists' flowers till next month. Transplant herbaceous plants in light soils, if not done in autumn; also deciduous trees, shrubs, and hedges. Lay edgings in fine weather. Sow mignonette, stocks, &c., in pots; sow sweet peas, and a few hardy annuals, on a warm border. Give auriculas and carnations abundance of air, but keep the roots rather dry, to prevent damping off.

FEBRUARY.

Kitchen Garden.—Sow successional crops of Early Seville beans, and William I., Advancer, Criterion, and other peas in the beginning and end of the month; early cabbages, to follow the last sowing in August; red cabbages and savoys towards the end. Sow also Early Horn carrot; Early Purple-top Munich turnip; onions for a full crop in light soils, with a few leeks and some parsley. Sow lettuce for succession, with radishes and Round-leaved spinach, twice in the course of the month; and small salads every fortnight. Plant Jerusalem artichokes, shallots, garlic, horse-radish, and early potatoes. Transplant for seed, if not done before, all the brassica tribe, including cabbage, cauliflower, turnip, &c.; also carrots, onions, beet, celery, endive, leeks, and parsnips. Transplant to the bottom of a south wall a portion of the peas sown in pots in frames in November and January for the first crop. Sow Brussels sprouts in gentle heat for an early crop.

Fruit Garden.—Prune apricots, peaches, nectarines, and plums, before the buds are much swelled; finish pruning apples, pears, cherries, gooseberries, currants, and raspberries, before the end of the month; also the dressing of vines. Keep the fruit-room free from spoiled fruit, and shut it close. Cut down the double-bearing

raspberries to secure strong autumn-fruited shoots. Head back stocks preparatory to grafting.

Forcing.—Sow melons and cucumbers on hotbeds and in pits. Sow carrots, turnips, early celery, also aubergines or egg-plants, capsicums, tomatoes, and successional crops of kidney-beans; cauliflower and Brussels sprouts, in gentle heat, to be afterwards planted out. Plant early potatoes on slight hotbeds. Continue the forcing of asparagus, rhubarb, and sea-kale. Pine-apple plants require little water; plants in dung-frames especially should be kept free from damp; shift the fruiting plants by the middle of the month, if not done in August. Commence or continue the forcing of the various choice fruits, as vines, peaches, figs, cherries, strawberries, &c. Pot roots of mint and place in heat to produce sprigs for mint sauce. Be careful to protect the stems of vines that are outside the forcing-houses.

Plant Houses.—Let the greenhouse and conservatory have plenty of air in mild weather. Pot and start tuberous-rooted begonias. Pot young plants of amaryllis, and start the established ones. Put plants of fuchsias, petunias, verbenas, heliotropes, salvias, and other soft-wooded subjects, into a propagating house to obtain cuttings, &c., for the flower garden. Sow stocks, dahlias, and a few tender and half-hardy annuals, on a slight hotbed, or in pots. Propagate old roots of dahlias by cuttings of the young shoots in a hotbed. Sow petunias in heat, and prick out and harden for bedding out; also gloxinias to be grown on in heat till the flowering season.

Flower Garden.—In dry open weather plant dried roots, including most of the finer florists' flowers; continue the transplanting of hardy biennial flowers and herbaceous plants. Sow in the last week mignonette, and hardy annuals, in a warm border, for subsequent transplanting.

MARCH.

Kitchen Garden.—Sow main crops of wrinkled marrow peas; Longpod and Windsor beans; Nonpareil or St John's day cabbages; onions, leeks, Early Horn carrots, parsnips, salsify, scorzonera, Brussels sprouts, borecoles, lettuces, and spinach. In the beginning and also at the end of the month sow Early Strap-leaf and Early Snowball turnips, and savoy. In the last fortnight sow asparagus, cauliflower, chervil, coriander, dill, fennel, finocchio, hyssop, marigold, savory; also sea-kale, radishes, celery, celeriac, and most of the culinary aromatics, as parsley. Small salads should be sown

every ten days. Make up beds for mushrooms with well-prepared dung towards the end of the month. Plant early potatoes in the first week, and a main crop during the last fortnight. Jerusalem artichokes, sea-kale, asparagus, and peas raised in frames, may now be planted; also garlic and shallots. Full crops of cabbages should be planted out; also cauliflowers under hand-glasses. Propagate by slips, or by earthing up the old stems, the various pot-herbs, as sage, savory, thyme, &c., and increase mint by dividing the roots.

Fruit Garden.—Finish the pruning of fruit trees before the middle of the month. Protect those coming into blossom. Begin grafting in the third week; dig and dress between the rows of gooseberries, currants, and other fruit trees, if not already done. Kill wasps assiduously, as soon as they appear.

Forcing.—Continue the forcing of melons and cucumbers, and the various fruits. Pot pine-suckers and crowns that have been kept in tan during winter, repotting those that require large pots, and about the middle of the month shifting them to the succession pit; give a top-dressing to the fruiting plants, turning the tan, and adding new bark to the pits, to keep up bottom-heat, where that is used. In the vinery and peach-house, attend to the keeping down of insects by syringing; and promote the growth of the young shoots, by damping the walls and paths morning and evening. Sow capsicum, egg-plant, and tomato; also in slight heat such tender herbs as basil and marjoram.

Plant Houses.—More water may be given than formerly. Sow seeds of greenhouse and hothouse plants; also the different sorts of tender annuals; pot off those sown last month; sow cineraria for the earliest bloom; also Chinese primulas. Shift heaths and other hard-wooded subjects and stove-plants; plant tuberose in pots for forcing. Begin to propagate greenhouse plants by cuttings; also coleuses by cuttings in heat, and chrysanthemums in moderate heat, potting them off as soon as rooted.

Flower Garden and Shrubbery.—In the last week, sow hardy annuals in the borders, with biennials that flower the first season, as also perennials. Plant anemone and ranunculus roots; plant the corms of gladiolus. Transplant from the nursery to their final sites annuals sown in autumn, with biennials and herbaceous plants. Propagate perennials from root-slips and offsets. Protect tulips, hyacinths, and choice flowers from severe weather. Continue to propagate the finer sorts of dahlias, both by cuttings and by division of the roots. Finish the pruning of all deciduous trees and hedges

as soon as possible. Attend to the dressing of shrubberies; lay turf-edgings, and regulate the surface of gravel walks.

APRIL.

Kitchen Garden.—Sow asparagus, sea-kale, Turnip-rooted beet, salsafy, scorzonera, skirret, carrots, and onions on heavy soils; also marrow peas, Longpod and Windsor beans, turnips, spinach, celery, Enfield Market cabbage, savoys, Brussels sprouts, and German greens, for succession. Sow broccoli and kidney beans both in the second and in the last week, and lettuces and small salads twice or thrice during the month; sow angelica, caraway, also all sweet herbs, if not done last month. Sow vegetable marrow. Plant cauliflower, cabbages, sea-kale, lettuce; and finish the planting of the main crops of potatoes; divide and replant artichokes. Propagate all sorts of pot-herbs, and attend to the hoeing and thinning of spinach, onions, turnips, &c. Earth up cabbages, cauliflower, peas, beans, and early potatoes. Stake up peas; blanch sea-kale and rhubarb in the open air, by covering with straw or leaves.

Fruit Garden.—If vines have been neglected to be pruned, rub off the buds that are not wanted; this is safer than pruning now. Protect the finer sorts of fruit trees on the walls. The hardier orchard-house fruits should now be moved outdoors under temporary awnings, to give the choicer fruits more space,—the roots being protected by plunging the pots. Mulch all newly-planted fruit trees, watering abundantly in dry weather.

Forcing.—Continue the preparation of succession beds and pits for cucumbers and melons. Sow basil in slight heat; pot and push on tomatos and capsicums. Attend to the routine culture of the pinery, giving water and air when necessary. In the forcing-houses, from the variable state of the weather, considerable vigilance is required in giving air. Keep down red spider (*Acarus*) in the more advanced houses by frequent syringings and a well-moistened atmosphere. Continue the usual operations of disbudding and thinning of fruit, and take care to keep up the proper temperatures.

Plant Houses.—Still sow tender annuals if required; sow cinerarias and primulas. Proceed with all necessary shiftings. Propagate rare and fine plants by cuttings or grafting; increase bouvardias by cuttings, and grow on for winter flowering. Pot off tender annuals, and cuttings of half-hardy greenhouse plants put in during February to get them well established for use in the flower garden.

Flower Garden and Shrubbery.—Sow main or successional crops of annuals of all sorts—half-hardy annuals in warm borders, or on slight hotbeds. Biennials and perennials should be sown before the middle of the month. Plant out gladioli, if not done, tigridias, and fine stocks. Finish the transplanting of herbaceous plants by the end of the first week. Protect stage auriculas and hyacinths from extremes of every description of weather; and tulips from hoar-frosts and heavy rains. Plant out tender deciduous trees and shrubs raised in pots; plant out tea-roses, mulching the roots. Remove part of the coverings of all tender shrubs and plants in the first week, and the remainder at the end of the month. Form and repair lawns and grass walks, by laying turf and sowing perennial grass-seeds; mow the lawns frequently; plant evergreens.

MAY.

Kitchen Garden.—Sow Pine-apple or Nutting's beet in the first week, small salads every week, radishes and lettuces thrice, spinach once a fortnight, carrots and onions for late drawing, kidney beans in the first week and together with scarlet runners in the last fortnight; endive for an early crop; also peas and Long-pod and Windsor beans, cauliflowers, Early York or Little Pixie cabbages, Brussels sprouts, borecole, broccoli, savoys, Buda kale, and German greens, for late crops. Sow anise and basil on a warm border; and borage and parsley on open spots. Sow vegetable marrows and hardy cucumbers on a warm border in the last week; sow cardoons in trenches, or (in the north) in pots under glass shelter; sow chicory for salading. Plant asparagus. Continue hoeing and earthing up the several crops.

Fruit Garden.—Disbud peaches, nectarines, and other early trees against the walls; also attend to the thinning of fruit. Give occasional washings with the engine to keep down insects. Pick caterpillars from gooseberries and wall trees on their first appearance. Remove from raspberries and strawberries all suckers and runners that are not wanted.

Forcing.—Plant melons and cucumbers, and some basil, on the hotbeds prepared for vegetables in February, and now free. Plant out vegetable marrows and pumpkins on dung-ridges, under hand-glasses. Sow late crops of cucumbers and melons. Continue the routine culture of the pinery, shifting those intended for autumn and winter fruiting; give abundance of heat and water, keeping down insects.

Plant Houses.—Turn out hardy plants about the middle, and the more tender at the latter end of the month. Sow tender annuals for succession, potting and shifting those sown at an earlier period; sow cinerarias for succession; and a few hardy annuals and ten-week stock, &c., for late crops. Pot off all rooted cuttings. Put in cuttings of the different desirable species which are now fit for that purpose. Plant out in rich soil Richardias, to be potted up in autumn for flowering.

Flower Garden.—Sow annuals for succession in the last week, also biennials and perennials in the nursery compartment, for planting out next year. Propagate plants of which more stock is required, either by cuttings or by dividing the roots. Plant out, during the last week, dahlias, hardy pelargoniums, stocks, and calceolarias, protecting the dahlias from slight frosts. By the end of the month, masses of the following plants may be formed with safety in warm localities:—pelargonium, heliotropium, fuchsia, petunia, nierenbergia, salvia, verbena, bouvardia, and lobelia. Protect tulips, ranunculuses, and anemones from the mid-day sun, and from rains and winds. Remove the coverings from all tender plants in the open air.

Shrubbery.—Transplant all kinds of evergreens, this month and September being the proper seasons. The rarer conifers should be planted now and in June, after they have commenced to grow. Proceed with the laying down of lawns and gravel-walks; and keep the former regularly mown.

JUNE.

Kitchen Garden.—Sow kidney beans for succession; also the wrinkled marrow peas, and Seville Longpod, and Windsor beans for late crops. Sow salading every ten days; also carrots, onions, and radishes for drawing young; and chicory for salads; sow endive for a full crop. In the first week sow Early Munich and Yellow Finland turnips for succession, and in the third week for a full autumn crop. Sow scarlet and white runner beans for a late crop, and cabbages for coleworts. Make up successional mushroom beds early in the month. Plant full crops of broccoli, Brussels sprouts, savoy, German greens, leeks, and early celery, with successional crops of cabbage and cauliflower. In the first fortnight of the month, plant hardy cucumbers for pickling, in a warm border, placing hand-glasses over them towards the end of the month. Plant out capsicums on a warm border (south of England), also tomatos

along the bottom of a south wall. Pull and store winter onions, if ripe.

Fruit Garden.—Train and prune the summer shoots of wall and trellis and other trained trees. Mulch and water fruit trees and strawberries in dry weather, desisting when the fruit begins to ripen. Net over cherry-trees. Destroy aphides and other insects by syringing with tobacco water, or by fumigating, or by dusting with tobacco powder.

Forcing.—Proceed with planting melons and cucumbers raised from seeds and cuttings, for late crops. Keep up the necessary temperatures for the ripening of the various fruits. Continue the routine operations in the pinery; but, if very large-sized fruit is desired, remove the suckers from the stem, and apply heat and water in abundance. Shift suckers and succession plants in the beginning and middle of the month, as the state of the plants may require. The other forcing-houses must still have the necessary heat, but little water and abundance of air must be given to those wherein the fruit is beginning to ripen, and those in which the fruit is past ought to be constantly under a system of thorough ventilation.

Plant Houses.—These will now be occupied with tender greenhouse plants and annuals, and the more hardy plants from the stove. Shift, repot, and propagate all plants that are desirable. Sow fragrant or showy annuals, to flower in pots during winter; and grow on a set of decorative plants for the same object.

Flower Garden.—Plant out dahlias and other tender subjects if risk of frost is past. Take up bulbs and tuberous roots, and dry them in the shade before removing them to the store-room. Fill up with annuals and greenhouse plants those beds from which the bulbs and roots have been raised. After this season, keep always a reserve of annuals in pots, or planted on beds of thin layers of fibrous matter, so as to be readily transplanted. Layer carnations and pipe pinks in the end of the month. Keep the lawns closely mown.

JULY.

Kitchen Garden.—Watering will be necessary in each department, if the weather is hot and dry. In the first week, sow peas for the last crop of the season; also Mammoth Longpod beans, and French beans. In the last week, sow Yellow Finland turnip for a full winter crop, spinach for an early winter supply, and Enfield Market or Winnigstadt cabbage for early summer use. Sow endive,

for autumn and winter use, in the beginning and end of the month ; also successional crops of lettuce and small salads. Make up successional mushroom beds. Plant full crops of celery, celeriac, endive, about the middle and end of the month ; late crops of broccoli, cauliflower, and coleworts in the last week. Gather and dry medicinal and pot herbs ; also propagate these by slips and cuttings.

Fruit Garden.—Continue the pruning and training of wall and espalier trees, and the destruction of noxious insects. Plant strawberries in pots for forcing next winter, and make new beds out of doors as soon as well-rooted runners can be obtained. Propagate the different sorts of stone fruit trees, by budding on other trees, or on prepared stocks. Gather fruits of all kinds as they ripen.

Forcing.—Prune melons and cucumbers, giving air and water, and maintaining heat, &c. Continue the routine treatment in the pinery, but withhold water when the fruit begins to ripen ; push on the growth of the suckers on old plants, which will materially advance the fruiting period. The forcing-houses ought to have abundance of fresh air and moisture, along with the necessary heat.

Plant Houses.—Ventilation will be necessary to keep down excessive heat ; and attention must be paid to potting, shifting, and putting in cuttings, and giving abundance of water to the potted plants, both indoors and out. Sow calceolarias ; shift heaths, if they require it ; cut down pelargoniums past flowering, and plant the cuttings.

Flower Garden and Shrubbery.—Take up the remaining tuberous roots, such as anemones, ranunculuses, &c., by the end of the first week ; fill up their places, and any vacancies that may have occurred, with annuals or bedding plants from the reserve ground. Repot auriculas, and sow auricula seed in boxes under glass. Propagate herbaceous and other plants that have gone out of flower, by means of cuttings and slips, especially those required for spring bedding ; propagate also the various summer bedding plants increased by cuttings. Increase roses and American shrubs, by layering, budding, or cuttings, and go on with the layering of carnations and picotees. Stake and tie up dahlias and strong herbaceous plants.

AUGUST.

Kitchen Garden.—Sow winter and spring spinach in the beginning and about the end of the month ; parsley and winter onions, for a full crop, in the first week ; cabbages about the middle of the month, for planting out in spring ; cauliflower in the first half

(Scotland) and in the second half (England) of the month ; Hardy Hammersmith and Brown Cos lettuce in the first and last week ; small salads occasionally ; and Black Spanish radish, for winter crops. Plant out kales and broccoli for late crops ; plant celery (earthing up the advancing crops as required), endive for succession, and a few coleworts. Take up shallots, garlic, &c.

Fruit Garden.—Proceed in training and regulating the summer shoots of all fruit trees as directed for the last three months. Net up, in dry weather, gooseberry and currant bushes, to preserve the fruit till late in the autumn. Make new strawberry beds if required. Preserve the ripening fruits on the wall and other trees from insects, and destroy wasp nests. Gather fruits as they ripen.

Forcing.—The routine of cultivation in hotbeds and pits may be continued. Sow, and propagate by cuttings, in the beginning of the month, cucumbers, to be afterwards grown in hot-water pits, or in boxes in the front of the pine-stove, for a winter crop. Make up mushroom beds for winter crop. In the pinery most of the summer fruit will be cut by the middle of the month, when a general shifting of succession plants will take place ; as also a potting of suckers ; but these will be strengthened by being allowed to remain on the old plants until the end of the month. In the forcing-houses, where the crops are past, part of the sashes may be removed, so as to permit thorough ventilation.

Plant Houses.—Attend to the propagation of all sorts of greenhouse plants by cuttings, and to the replacing in the greenhouse and stoves the more tender species, by the end of the month in ordinary seasons, but in wet weather in the second week. Sow half-hardy annuals, as *Nemophila*, *Collinsia*, *Schizanthus*, *Rhodanthe*, &c., to flower during winter.

Flower Garden and Shrubbery.—Sow in the second and the last week, on a warm border of a light sandy soil, with an east aspect, any free-flowering hardy annuals as *Silene pendula*, *Nemophila*, &c., for planting in spring ; and auricula and primula seeds in pots and boxes. Propagate all sorts of herbaceous plants by rooted slips ; layer chrysanthemums ; take off layers of carnations, picotees, and pansies. Plant cuttings of bedding plants, and of bedding pelargoniums in boxes for convenience of removal. Layer the tops of chrysanthemums, to obtain dwarf flowering plants. Transplant evergreens in moist weather, about the end of the month ; and propagate them by layers and cuttings. Pot Neapolitan violets for forcing ; or plant out on a mild hotbed. Clip box edgings.

SEPTEMBER.

Kitchen Garden.—Sow small salading for late crops ; and lettuce and spinach, if not done last month, for spring crops. Plant endive and lettuce at the foot of a south wall to stand the winter ; plant out cabbages from the chief autumn sowing. Plant cauliflowers on a warm border in spaces such as can be protected by hand-lights. Thin the winter spinach, when large enough, that it may have space to grow. If broccoli be too rank or tall to withstand the winter, lift and lay nearly up to the neck in the earth, the heads sloping towards the north. Lift onions, and lay them out to ripen on a dry border or gravel-walk. Lift potatoes and store them.

Fruit Garden.—Finish the summer pruning and training. Where the walls are heated, assist the maturing of peaches and nectarines, and the ripening of the young wood for next year, by fires during the day. Gather and lay up in the fruit-room with care the autumnal sorts of apples and pears. Prepare borders and stations for fruit trees during dry weather. Plant strawberries for a main crop. Repot orchard-house trees, disrooting if necessary.

Forcing.—Take care that late melons and cucumbers be not injured by getting too much water, and too little air. Sow a few kidney beans for an early forced crop. In the pinery at once take off and pot all strong suckers not done last month ; the remainder may be taken off at the end of the month, and planted in old tan in a frame or pit. Expel damp, and assist the ripening of late grapes and peaches, with fires during the day. Prune early vines and peaches.

Plant Houses.—The various pot plants should now be put in their winter quarters. Keep up moderate temperatures in the stove, and merely repel frosts in the greenhouse, guarding against damp, by ventilation and by the cautious use of water. Pot hyacinths, tulips, and other bulbs for forcing ; and propagate half-hardy plants by cuttings.

Flower Garden, &c.—Sow in the beginning of this month all half-hardy annuals required for early flowering ; also mignonette in pots, thinning the plants at an early stage ; the different species of primula ; and the seeds of such plants as, if sown in spring, seldom come up the same season, but if sown in September and October, vegetate readily the succeeding spring. Put in cuttings of bedding pelargoniums in boxes, which may stand outdoors exposed to the sun, but should be sheltered from excessive rains. Continue the propagation of herbaceous plants, taking off the layers of carnations, picotees, pansies, and chrysanthemums, by the end

of the month ; choice carnations and picotees may be potted and wintered in cold frames if the season is wet and ungenial. Plant evergreens ; lay and put in cuttings of most of the hard-wooded sorts of shrubby plants.

OCTOBER.

Kitchen Garden.—Sow small salading and radishes in the first week, and lettuces in frames on a shallow hotbed for planting out in spring. If the winter prove mild they will be somewhat earlier than those sown next month or in January. Plant parsley in pots or boxes to protect under glass in case very severe weather occurs. Plant cabbages in beds or close rows till wanted in spring ; and cauliflowers in the last week, to receive the protection of frames, or a sheltered situation. Store potatoes, beet, salsafy, scorzonera, skirret, carrots, and parsnips, by the end of the month. Band and earth up cardoons.

Fruit Garden.—Such fruit trees as have dropped their leaves may be transplanted ; this is the best season for transplanting (though with care it may be done earlier), whether the leaves have fallen or not. Protect fig-trees, if the weather proves frosty, as soon as they have cast their leaves. Plant out raspberries. The orchard-house trees should be got under glass before the end of the month. Gather and store all sorts of apples and pears, the longest-keeping sorts not before the end of the month, if the weather be mild.

Forcing.—Maintain the heat in hotbeds and pits by means of fresh dung linings. Give abundance of air in mild bright weather. Dress vines and peaches. Clean and repair the forcing-houses, and overhaul the heating apparatus to see it is in good working condition. Plant chicory or witloef in boxes or on hotbeds for blanching. Sow kidney beans. Make up successional winter mushroom beds.

Plant Houses.—Replace all sorts of greenhouse plants. Fill the pits with pots of stocks, mignonette, and hardy annuals for planting out in spring, along with many of the hardy sorts of greenhouse plants ; the whole ought to be thoroughly ventilated, except in frosty weather. From this time till spring keep succulent plants almost without water. Sow cyclamens. Begin to force roses, hyacinths, and a few other bulbs, for winter and early spring decoration. Plant hyacinths in glasses for windows.

Flower Garden.—Sow a few pots of hardy annuals in a frame, or on a sheltered border, for successional spring use if required. Plant the greater part of the common border bulbs as hyacinths, narcissi,

crocuses, and early tulips, about the end of the month, with a few anemones for early flowering. Transplant strong plants of biennials and perennials to their final situations ; also the select plants used for spring bedding. Protect alpine plants, stage auriculas, and carnations and picotees with glass frames ; and half-hardy greenhouse plants, such as fuchsias, &c., about the end of the month, with coverings of broom or spruce-fir, preferring the latter. Take up, dry, and store dahlias and all tender tubers in the end of the month ; pot lobelias and similar half-hardy plants from the open borders. Transplant all sorts of hardy evergreens and shrubs, especially in dry soils, giving abundance of water. Put in cuttings of all sorts of evergreens, &c. Plant out the hardier sorts of roses.

NOVEMBER.

Kitchen Garden.—Trench up all vacant ground as soon as cleared of its crops, leaving the surface as rough as possible. Sow Dillistone's Early peas and Early Dwarf Prolific beans, in the second week, for an early crop ; also in frames for transplanting. Protect endive, celery, artichoke, and sea-kale, with stable-litter or fern, or by planting the former in frames ; take up late cauliflower, early broccoli, and lettuces, and place them in sheltered pits or lay them in an open shed ; earth up celery ; manure and dress up asparagus beds.

Fruit Garden.—Plant all sort of fruit trees in fine weather—the earlier in the month the better. Protect fig-trees. Commence pruning and nailing. Gather and store the latest apples and pears. Examine the fruit room, and remove all decayed fruit.

Forcing.—Keep up the requisite degree of heat in hotbeds and pits. Cucumbers and pines, on hotbeds, will require more than ordinary attention, to prevent them damping off from too much moisture ; hence the advantage of hot-water heating. Force asparagus, rhubarb, and sea-kale, in the mushroom-house, in pits, or in the open border under boxes or cases surrounded and covered by well-fermented stable dung and leaves. Sow Early Horn carrot ; also kidney beans and radishes, on hotbeds. In the forcing-houses prune and train the trees ; fork over and dress the borders of such houses as have not been already done.

Plant-Houses.—The directions for the greenhouse and conservatory in January apply also to this month generally. Continue the forcing of roses, hyacinths, &c.

Flower Garden, &c.—Plant dried tubers of border flowers, but the finer sorts had better be deferred till spring. Plant tulips in the early part of the month. Put in cuttings of bedding calceolarias, choosing the shoots that will not run up to flower. Protect such half-hardy plants as are not already sheltered. Plant deciduous trees and shrubs so long as the weather continues favourable, and before the soil has parted with the solar heat absorbed during summer. Dig and dress such flower borders and shrubberies as may now be cleared of annuals and the stems of herbaceous plants.

DECEMBER.

Kitchen Garden.—Collect and smother-burn all vegetable refuse, and apply it as a dressing to the ground. Sow a few peas and beans, in case of accident to those sown in November, drawing up the soil towards the stems of those which are above ground as a protection; earth up celery; blanch endive with flower-pots; sow radishes in a very sheltered place. Attend to trenching and digging in dry weather.

Fruit Garden.—Plant all sorts of fruit trees in mild weather. Proceed with pruning and nailing wall-trees. Examine the fruit-room every week, removing promptly all decaying fruit.

Forcing.—The same degree of attention to hotbeds and pits will be necessary as in the last month. Continue the forcing of asparagus, rhubarb, and sea-kale, in pits and in the mushroom-house. Proceed with the usual routine of culture commenced last month. Make the necessary preparations to begin forcing early or succession crops by the last week of this or the first of next month.

Plant-Houses, Frames, &c.—Carnations and picotees in pots must be kept rather dry to prevent damping off. Heaths and Australian plants must be very sparingly watered, and kept with only fire heat enough to repel frost.

Flower Garden, &c.—Plant shrubs in open weather. Prune hardy roses and other hardy shrubs. Sweep and roll the lawns, and put in repair the gravel-walks, keeping the surface frequently rolled.

CHAPTER X.

CALENDAR OF GARDEN OPERATIONS

For the United States, latitude of New York.

The accompanying brief calendrical directions have been furnished by Mr Peter Henderson, florist, Jersey City.

JANUARY.

Flower Garden and Greenhouse.—Little is to be done in either. In the greenhouse care must be used to protect against frost. Ventilate but little, and with care; raise the ventilating sash only high enough to let the heated air from the greenhouse drive back the outer air so as not to chill the plants. To destroy the red spider, syringe the plants copiously at night, and splash the paths with water. The aphid, or "green fly," must also be destroyed; tobacco may be used. At this season roses, grape vines, and other plants are often affected by mildew; an effectual remedy is to paint the hot-water pipes with a mixture of sulphur and lime, put on as thick as ordinary whitewash, once each week until it is checked; but care must be taken not to apply it on any surface at a higher temperature than 212°. Hyacinths and other bulbs that have been kept in a cellar or other dark cool place may now be brought into the light of the greenhouse or sitting room, provided they have filled the pots with roots. If they are not well rooted, leave them until they are, or select such of them as are best, leaving the others. In the outside flower garden little can be done except that shrubs may be pruned, or new work, such as making walks or grading, performed, if weather permits.

Fruit Garden.—Pruning, staking up, or mulching can be done if the weather is such that the workmen can stand out. No plant is injured by being pruned in cold weather.

Grapery.—Graperies used for the forcing of foreign grapes may be started, beginning at a temperature of 50° at night, with 10° or 15° higher during the day. The borders must be covered sufficiently deep with leaves or manure to prevent the soil from freezing, as it would be destruction to the vines to start the shoots if the roots were frozen; hence, when forcing is begun in January, the covering should be put on in November, before severe frosts begin.

Vegetable Garden.—But little can be done in the Northern States except to prepare manure, and get sashes, tools, &c., in working order; but in sections of the country where there is little or no frost the harder kinds of seeds and plants may be sown and planted, such as asparagus, cabbage, cauliflower, carrot, leek, lettuce, onion, parsnip, peas, spinach, turnip, &c. In any section where these seeds can be sown in open ground, it is an indica-

tion that hotbeds may be started for the sowing of such tender vegetables as tomatoes, egg and pepper plants, &c.; though, unless in the extreme Southern States, hotbeds should not be started before the beginning or middle of February.

FEBRUARY.

Flower Garden and Greenhouse.—The directions for January will in the main apply to this month, except that now some of the hardier annuals may be sown in hotbed or greenhouse, and also the propagation of plants by cuttings may be done rather better now than in January, as the greater amount of light gives more vitality to the cutting.

Fruit Garden.—But little can be done in most of the Northern States as yet, and in sections where there is no frost in the ground, it is likely to be too wet to work; but in many Southern States this will be the best month for planting fruit trees and plants of all kinds, particularly strawberries, raspberries, blackberries, pear and apple trees, while grape vines will do, though they will also do well quite a month later.

Grapery.—The graperies started last month at 50° at night may now be increased to 60°, with a correspondingly higher day temperature. Great care must be taken to syringe the leaves thoroughly at least once a day, and to deluge the paths with water, so as to produce a moist atmosphere. Paint the hot-water pipes with sulphur mixture, as recommended in January.

Vegetable Garden.—Leaves from the woods, house manure, or refuse hops from breweries may be got together towards the latter part of this month, and mixed and turned to get "sweetened" preparatory to forming hotbeds. Cabbage, lettuce, and cauliflower seeds, if sown early this month in hotbed or greenhouse, will make fine plants if transplanted into hotbed in March. This is preferable to the use of fall-sown plants. Manure that is to be used for the crop should be broken up as fine as possible, for the more completely manure of any kind can be mixed with the soil the better the crop will be, and, of course, if it is dug or ploughed in in large unbroken lumps it cannot be properly commingled.

MARCH.

Flower Garden and Greenhouse.—The long days and bright sunshine will now begin to tell on the plants under glass. Examine all plants that are vigorous and healthy; if the roots have matted the "ball" of earth they must be shifted into a larger-sized pot. Plants from cuttings struck last month may now be shifted, and the propagation of all plants that are likely to be wanted should be continued. Hardier kinds of annuals may be sown; it is best done in shallow boxes, say 2 inches deep. Lawns can be raked off and mulched with short manure, or rich garden earth where manure cannot be obtained. Flower beds on light soils may be dug up so as to forward the work of the coming busy spring season.

Fruit Garden.—In many sections, planting may now be done with safety, provided the soil is light and dry, but not otherwise. Again at this season, although a tree or plant will receive no injury when its roots are undisturbed in the soil, should a frost come after planting, the same amount of freezing will and very often does greatly injure the plant if the roots are exposed.

Grapery.—The graperies started in January will have set its fruit, which should be thinned by one-third. The temperature may now be farther advanced to 70° at night, with 15° higher in the daytime. The same precautions must be used against mildew and insects as given in January. Graperies wanted for succession may be started in February or this month.

Vegetable Garden.—This is a busy month. In localities where the frost is out of the ground, if it is not wet, seeds of the hardier vegetables can be sown. The list of seeds given for the Southern States in January may now be used at the North, while for most of the Southern States tender vegetables, such as egg plant, okra, sweet potatoes, melon, squash, potatoes, tomatoes, &c., may be sown and planted. Hotbeds must now be all started.

APRIL.

Flower Garden and Greenhouse.—Window and greenhouse plants require more water and ventilation. Due attention must be paid to shifting well-rooted plants into larger pots; and, if space is desired, many kinds of hardier plants can be safely put out in cold frames. Towards the end of the month it may be necessary to slightly shade the glass of the greenhouse. All herbaceous plants and hardy shrubs may be planted in the garden. The covering of leaves or litter should be taken off bulbs and tender plants that were covered up for winter, so that the beds can be lightly forked and raked. Sow tender annual flower seeds in boxes inside.

Fruit Garden.—Strawberries that have been covered up with straw or leaves should be relieved around the plants, leaving the covering between them. Raspberries, grape vines, &c., that have been laid down, may now be uncovered and tied up to stakes or trellises, and all new plantations of these and other fruits may now be made.

Vegetable Garden.—Asparagus, rhubarb, spinach, &c., should be uncovered, and the beds hoed or dug lightly. Hardier sorts of vegetable seeds and plants, such as beets, cabbage, cauliflower, celery, lettuce, onions, parsley, parsnip, peas, potatoes, radishes, spinach, turnip, &c., should all be sown or planted by the middle of the month if the soil is dry and warm, and in all cases, where practicable, before the end of the month. It is essential, in sowing seeds now, that they be well firmed in the soil. Any who expect to get early cabbage, cauliflower, lettuce, or radishes, while planting or sowing is delayed until the time of sowing tomato and egg plant in May, are sure to be disappointed of a full crop.

MAY.

Flower Garden and Greenhouse.—Window and greenhouse plants should be in their finest bloom. Firing may be entirely dispensed with, though care must still be exercised in ventilating. Every precaution must be used to keep the air moist. "Moss culture" may be tried, the common sphagnum or moss of the swamps, mixed with one-twentieth of its bulk of bone-dust, being laid as a mulch on the top of the earth of the flower-pots; its effect is to shield the pots from the sun, and at the same time stimulate the roots to come to the surface. By the end of the month all of the plants that are wanted for the summer decoration of the flower border may be planted out, first loosening a little the ball of earth at the roots. If the weather is dry, water freely after planting. When the greenhouse is not to be used during the summer months, camellias, azaleas, and plants of that character should be set out of doors under partial shade; but most of the other plants usually grown in the conservatory or window garden in winter may be set in the open border. Flower beds should be kept well hoed and raked, to prevent the growth of weeds next month. Lawns should be mown, and the edgings trimmed. Pelargoniums, pinks, monthly roses, and all the half-hardy kinds of flowering plants should be planted early; but coleus, heliotrope, and the more tender plants should be delayed until the end of the month. Annuals

that have been sown in the greenhouse or hotbed may be planted out, and seeds of such sorts as mignonette, sweet alyssum, phlox Drummondii, portulaca, &c., may be sown in the beds or borders.

Fruit Garden.—The hay or leaf mulching on the strawberry beds should be removed and the ground deeply hoed, after which it may be placed on again to keep the fruit clean and the ground from drying. Where it has not been convenient before, most of the smaller fruits may yet be planted during the first part of the month. Tobacco dust will dislodge most of the numerous kinds of slugs, caterpillars, or worms that make their appearance on the young shoots of vines or trees.

Vegetable Garden.—Attention should be given to new sowings and plantings for succession. Crops sown last month will have to be thinned out if large enough. Hoe deeply all transplanted crops, such as cabbage, cauliflower, lettuce, &c. Tender vegetables, such as tomatoes, egg and pepper plants, sweet potatoes, &c., can be planted out. Seeds of Lima beans, sweet corn, melon, okra, cucumbers, &c., should be sown; and for succession peas, spinach, lettuce, beans, radishes, &c., every ten days.

JUNE.

Flower Garden and Greenhouse.—Tropical plants can now be used to fill up the greenhouse during the summer months. It should be well shaded, and fine specimens of fancy caladiums, dracenas, coleus, crotons, palms, ferns, and such plants as are grown for the beauty of their foliage, will make a very attractive show. The "moss culture" will be found particularly valuable for these plants. Hyacinths, tulips, and other spring bulbs may be dug up, dried, and placed away for next fall's planting, and their places filled with bedding plants, such as coleus, achyranthes, pelargoniums, and the various white and coloured-leaved plants. It will be necessary to mow the lawn once a week.

Fruit Garden.—The small fruits should be mulched about the roots, if this has not yet been done. Grape vines outside as well as in should be disbudded.

Vegetable Garden.—Beets, beans, carrots, corn, cucumbers, lettuce, peas, and radishes may be sown for succession. This is usually a busy month, as many crops have to be gathered, and, if hoeing is not promptly seen to, weeds are certain to give great trouble. Tomatoes should be tied up to trellises or stakes if fine-flavoured and handsome fruit is desired, for if left to ripen on the ground they are apt to have a gross earthy flavour.

JULY.

Flower Garden and Greenhouse.—Watering, ventilating, and fumigating (or the use of tobacco in other forms for destruction of aphides) must be attended to. The atmosphere of the greenhouse must be kept moist. Watch the plants that have been plunged out of doors, and see if any require repotting. All plants that require staking, such as dahlias, roses, gladioli, and many herbaceous plants, should now be looked to. Carnations and other plants that are throwing up flower stems, if wanted to flower in winter, should be cut back, that is, the flower stems should be cut off to say 5 inches from the ground.

Fruit Garden.—If grape vines show any signs of mildew, dust them over with dry sulphur, selecting a still warm day. The fruit having now been gathered from strawberry plants, if new beds are to be formed, the system of layering the plants in small pots is the best. Where apples, pears, peaches,

grapes, &c., have set fruit thickly, thin out at least one-half to two-thirds of the young fruit.

Vegetable Garden.—The first ten days of this month will yet be time enough to sow sweet corn, beets, lettuce, beans, cucumbers, and ruta-baga turnips. Such vegetables as cabbage, cauliflower, celery, &c., wanted for fall or winter use, are best planted this month, though in some sections they will do later. Keep sweet potatoes hoed to prevent the vines rooting at the joints.

AUGUST.

Flower Garden and Greenhouse.—But little deviation is required in these departments from the instructions for July.

Fruit Garden.—Strawberries that have fruited will now be making "runners" or young plants. These should be kept cut off close to the old plant, so that the full force of the root is expended in making the "crowns" or fruit buds for next season's crop. If plants are required for new beds, only the required number should be allowed to grow, and these should be layered in pots as recommended in July. The old stems of raspberries and blackberries that have borne fruit should be cut away, and the young shoots thinned to three or four canes to each hill or plant. If tied to stakes and topped when 4 or 5 feet high, they will form three or four branches on a cane, and will make stronger fruiting plants for next year.

Vegetable Garden.—Hoe deeply such crops as cabbage, cauliflower, and celery. The earthing up of celery this month is not to be recommended. Onions in many sections can be harvested. The proper condition is when the tops are turning yellow and falling down. They are dried best by placing them in a dry shed in thin layers. Sow spinach for fall use, but not yet for the winter crop. Red top, white globe, and yellow Aberdeen turnips should now be sown; ruta-baga turnips sown last month will need thinning, and in extreme Southern States they may yet be sown.

SEPTEMBER.

Flower Garden and Greenhouse.—The flower beds on the lawn should be at their best. If planted in "ribbon lines" or "massing," strict attention must be given to pinching off the tops, so that the lines or masses will present an even surface. Tender plants will require to be put in the greenhouse or housed in some way towards the end of this month; but be careful to keep them as cool as possible during the day. Cuttings of bedding plants may now be made freely if wanted for next season, as young cuttings rooted in the fall make better plants for use next spring than old plants, in the case of such soft-wooded plants as pelargoniums, fuchsias, verbenas, heliotropes, &c.; with roses and plants of a woody nature, however, the old plants usually do best. Dutch bulbs, such as hyacinths, tulips, crocus, &c., and most of the varieties of lilies, may be planted. Violets that are wanted for winter flowering will now be growing freely, and the runners should be trimmed off. Sow seeds of sweet alyssum, candytuft, daisies, mignonette, pansies, &c.

Fruit Garden.—Strawberry plants that have been layered in pots may yet be planted, or in southern districts the ordinary ground layers can be planted. The sooner in the month both are planted the better crop they will give next season; and, as these plants soon make runners, it will be necessary to trim them off. Attend to raspberries and blackberries as advised for last month, if they have not already been attended to.

Vegetable Garden.—If cabbage, cauliflower, and lettuce are wanted to plant in cold frames, the seed should be sown from about the tenth to the twentieth

of this month; but judgment should be exercised, for, if sown too early, cabbage and cauliflower are apt to run to seed. The best date for latitude of New York is September 15th. The main crop of spinach or sprouts that is wanted for winter or spring use should be sown about the same date. The earth should be drawn up to celery with a hoe preparatory to earthing up with a spade. Onions that were not harvested and dried last month must now be attended to. Turnips of the early or flat sorts may yet be sown the first week of this month in the Northern States, and in the South from two to four weeks later.

OCTOBER.

Flower Garden and Greenhouse.—In northern sections of the United States, tender plants that are still outside should be got under cover as early as possible. Delay using fire heat as long as possible, unless the nights become so cold as to chill the plants inside the house. Roses, carnations, camellias, azaleas, pelargoniums, and the hardier sorts of plants will do better if placed in a cold frame or pit until the middle of November than they would in an ordinary greenhouse. Look out for insects. Fall bulbs of all kinds may be planted. Take up summer-flowering bulbs and tubers, such as dahlias, tuberose, gladioli, cannas, caladiums, tigridias, and dry them off thoroughly, stowing them away afterwards in some place free from frost and moisture during winter.

Fruit Garden.—Strawberries that have been grown from pot-grown layers may yet be planted in Southern States; keep the runners trimmed off. Fruit trees and shrubs may be set out; but, if planting is deferred to the last of the month, the ground around the roots should be mulched to the thickness of 3 or 4 inches with straw, leaves, or rough manure, as a protection against frost.

Vegetable Garden.—Celery will now be in full growth, and will require close attention to earthing up, and during the last part of the month the first lot may be stored away in trenches for winter. All vegetable roots not designed to be left in the ground during the winter should be dug up, such as beets, carrots, parsnips, sweet potatoes, &c. The cabbage, cauliflower, and lettuce plants grown from seed sown last month should be pricked out in cold frames. If lettuce is wanted for winter use, it may now be planted in the greenhouse or cold frame, and will be ready for use about Christmas. If asparagus or rhubarb is wanted for winter use, it should be taken up and stowed away in pit, frame, shed, or cellar for a month or two. It may then be taken into the greenhouse and packed closely together under the stage, and will be fit for use from January to March, according to the temperature of the house.

NOVEMBER.

Flower Garden and Greenhouse.—Plants intended to be grown inside should now all be indoors. Keep a sharp look out for cold snaps, as they come very unexpectedly in November, and many plants are lost thereby. In cases where it is not convenient to use fire heat, 5° to 10° of cold can be resisted by covering the plants over with paper, and by using this before frost has struck the plants valuable collections may be saved. When fire heat is freely used, be careful to keep up the proper amount of moisture by sprinkling the paths with water. Little can be done in the flower garden, except to clean off all dead stalks, and straw up tender roses, vines, &c., and, wherever there is time, to dig up and rake the borders, as it will greatly facilitate

spring work. Cover up all beds in which there are hyacinths, tulips, and other bulbs with a litter of leaves or straw to the depth of 2 or 3 inches. If short thoroughly-decayed manure can be spared, a good sprinkling spread over the lawn will help it to a finer growth next spring.

Fruit Garden.—Strawberry beds should be covered (in cold sections) with hay, straw, or leaf mulching, to a depth not exceeding 2 inches. Fruit trees and grape vines generally should be pruned; and, if the wood of the vine is wanted for cuttings, or scions of fruit trees for grafts, they should be tied in small bundles and buried in the ground until spring.

Vegetable Garden.—Celery that is to be stored for winter use should be put away before the end of the month in all sections north of Virginia; south of that it may be left in most places where grown throughout the winter if well covered up. The stalks of the asparagus plants should be cut off, and burned if there are berries on them, as the seeds scattered in the soil sometimes produce troublesome weeds. Mulch the beds with 2 or 3 inches of rough manure. All vegetable roots that are yet in the ground, and not designed to be left there over winter, must be dug up in this latitude before the middle of the month, or they may be frozen in. Cover up onions, spinach, sprouts, cabbage, or lettuce plants with a covering of 2 or 3 inches of leaves, hay, or straw, to protect them during the winter. Cabbages that have headed may usually be preserved against injury by frost until the middle of next month, by simply pulling them up and packing them closely in a dry spot in the open field with the heads down and roots up. On approach of cold weather in December they should be covered up with leaves as high as the tops of the roots, or, if the soil is light, it may be thrown over them, if leaves are not convenient. Cabbages will keep this way until March if the covering has not been put on too early. Plough all empty ground if practicable, and, whenever time will permit, do trenching and subsoiling. Cabbage, cauliflower, and lettuce plants that are in frames should be regularly ventilated by lifting the sashes on warm days, and on the approach of very cold weather they should be covered with straw mats or shutters. In the colder latitudes, and even in the Middle States, it is absolutely necessary to protect cauliflower in this way, as it is much more tender than cabbage and lettuce plants.

DECEMBER.

Flower Garden and Greenhouse.—Close attention must be paid to protecting all tender plants, for it is not uncommon to have the care of a whole year spoiled by one night's neglect. Vigilance and extra hot fires will have to be kept up when the thermometer falls to 34° or 35° in the parlour or conservatory. It is well to set the plants under the benches or on the walks of the greenhouse; if they are in the parlour, move them away from the cold point and protect them with paper; this will usually save them even if the thermometer falls to 24° or 26°. Another plan in the greenhouse is to dash water on the pipes or flues, which causes steam to rise to the glass and freeze there, stopping up all the crevices. With plants outside that require strawing up or to be mulched, this will have now to be finished.

Fruit Garden.—In sections where it is an advantage to protect grape vines, raspberries, &c., from severe frost, these should be laid down as close to the ground as possible, and covered with leaves, straw, or hay, or with a few inches of soil.

Vegetable Garden.—Celery in trenches should receive the final covering for the winter, which is best done by leaves or light stable litter; in the latitude

of New York it should not be less than 12 inches thick. Potatoes, beets, turnips, or other roots in pits, the spinach crop in the ground, or any other article in need of protection, should be attended to before the end of the month; manure and compost heaps should be forwarded as rapidly as possible, and turned and mixed so as to be in proper condition for spring. Remove the snow that accumulates on cold frames or other glass structures, particularly if the soil which the glass covers was not frozen before the snow fell; it may remain on the sashes longer if the plants are frozen in, since they are dormant, and would not be injured if deprived of light for eight or ten days. If roots have been placed in cellars, attention must be given to ventilation, which can be done by making a wooden box, say 6 by 8 inches, to run from the ceiling of the cellar to the eaves of the building above.



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